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EDITORIAL ANNOUNCEMENTS

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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Mr. P. H. Griffin's paper on the manufacture of chilled car wheels, printed in another column, presents in plain terms the wheel maker's position in the controversy over the failure of such wheels under high capacity cars. He contends that many of the failures are due to careless mounting of wheels of different diameter on the same axle, running unbalanced and eccentric wheels under heavily loaded cars at high speeds and improper adjustment and manipulation of the brake apparatus; these failures being entirely aside from those which are directly due to the use of cheap materials to meet the prices which the railroads are willing to pay or the endeavor of the wheel makers to produce a wheel which will meet the test requirements imposed without regard to the service expected of the wheel. Broadly speaking, he blames the railroads for their own sins and for forcing the manufacturers to fall into error also in attempting to make cheap wheels out of cheap material. The situation is unfortunate, and the railroads are no doubt to a great extent responsible for its existence, but the wheel makers are not altogether blameless in continuing to furnish wheels which they admit will not stand the required service, although they may pass the tests imposed. They protest because they are forced to guarantee a product which they know to be bad, but which they doctor up to pass tests designed to show that it is good.

It seemed last year as though there might be some harmony of purpose established between the wheel makers and the railroads after the deliberations of the Joint Committee of the wheel makers and the Master Car Builders' Association which led to the recommendation of so-called standard specifications for cast-iron wheels; specifications presumably satisfactory to the majority on both sides. Apparently, however, there is as much contention as ever. We still have faith in the future possibilities of the cast-iron wheel and believe that in the end the railroads will come to the conclusion that they cannot expect to get a high-grade wheel which will meet service requirements under heavy cars for the same price that they have paid in the past for light wheels made of poor material. When the failures of poor cast-iron wheels have become so numerous as to bring the railroads face to face with the only alternative left—the use of some form of rolled steel or steel-tired wheel at a prohibitive price—then a good cast-iron wheel of superior metal and workmanship can be sold at the higher prices, which the railroads now refuse to pay. It is pretty good evidence that there are still some roads which have confidence in the ability of cast-iron wheels when properly made to stand the severe service of modern conditions, when we see three or four of the largest users building and operating their own foundries. They make good wheels and do not spare expense in doing so, and their experience is not disquieting for the future.

The single objection to the use of coal-tar creosote for preserving railroad ties and bridge timber is its cost. When the wood tissue only is impregnated, and the air cells are left empty, the amount of oil saved is about six-tenths of the amount used in other methods which leave the cells full of free oil which does no good, but slowly bleeds out, notably when warm weather expands air left in the wood. Free oil in the wood cells not only does no good, it does harm, especially in soft woods, in lubricating the spikes so that they have too little hold in the ties. The Rueping process of injecting a preservative, shown and described in another column, looks like an important economy. It is a method only, adapted to using any preservative, but its highest economy is shown when using the most expensive material—creosote. Mr. von Schrenk recently showed to the writer an entirely sound section of a Baltic Fir about 10 in. in diameter, which was treated with creosote in 1854 to a depth of about 1½ in. At the Paris Exposition, 1889, a sound tie was shown, which had been treated with creosote and had been in the track for 46 years. It is evident that timber treated as fully and deeply as that shown in the photographs will not decay. The limit of life of such ties will be measured not by time, but by the volume and speed of the tonnage passing over them. The present cost of coal-tar creosote in this country is about 8 cents a gallon, for the reasons that the present available supply is controlled, and that the cost of plant for saving this by-product at coke ovens and gas works is too considerable unless a steady demand is assured. That is to say, the two industries, producing and using, are not correlated. The earlier costs of creosote treatment have been prohibitive, but the cost of ties has been steadily increasing each decade, until now it is plain that, since the life of ties of cheap wood can be more than doubled, there is great economy in preventing decay, if the cost is not too great. In England, where creosote can be had at two-thirds of its price here, the cost of creosoting under pressure a 5 in. x 12 in. x 8 ft. sleeper is said to be about 17 pence (34 cts.). On one English railroad, Baltic Fir sleepers of the above dimensions, thoroughly seasoned, are allowed to lie in a tank of creosote under no pressure for 24 hours. These sleepers cost 3 shillings 6 pence, and the creosoting costs 9 pence, making the total cost about $1.03. Their life has been over 14 years. The present price of yellow pine ties, 7 in. x 9 in. x 8 ft. in New York is not far from 60 cents. The Rueping process, with full impregnation of all the sap wood, as shown in the photographs on another page, is said to cost only 20 cents. Such an 80-cent tie will probably never decay in service. If, also, as is claimed, its spike-holding quality is not lessened by the creosote when injected

in this way, its life should be simply proportional to the strength of the timber and the weight and speed of the loads passing over it. Its theoretical economy is a matter of simple arithmetic, but a fair trial is better.

THE VANDERBILT LINES' FREIGHT CAR REPAIR POOL.

The freight car repair pool of the Vanderbilt lines, which is described in another column, is another step in the closer consolidation of this great system of railroads following the recent reorganization of the executive departments by which Mr. Newman became President of all of the roads owned and controlled by the Vanderbilt interests. It will become effective on July 1, and will include the entire freight car equipment, with a few exceptions, of all of the 19 allied lines, numbering some 150,000 cars. The scheme as outlined is equitable in its adjustments and simple in its operation, a central clearing house handling all the accounts and rendering monthly statements of expenses and credits for each road, based on the road's proportion of the total car mileage made on all lines in the pool during the preceding month. For some years the equipment of the various roads has practically been pooled by the operating department in loading cars for shipments to points on the Vanderbilt lines, no effort being made to route cars home at once. Nor is the idea of a pool for facilitating repairs entirely new, a system somewhat similar to the one soon to be put in use having been in successful operation on the Pennsylvania Railroad and its allied lines for a number of years.

The system of rendering accounts for repairs to foreign cars in general use throughout the United States is complicated, and involves a large amount of clerical work. At times, also, differences arise as to the correctness of bills, resulting in endless correspondence. Between the roads in the pool this will be done away with entirely, and, inasmuch as there exists a practical pool in the car service departments, by far the largest part of the billing for repairs now done will no longer be required, since no bills will be exchanged between roads in the pool. By repairing cars belonging in the pool at the nearest pool shops a great saving in empty car mileage will be effected, since bad order cars will no longer be routed home for repairs. The number of inspectors required at interchange points on roads in the pool will also be reduced; the inspection of pool cars will cover safety only, and this can be done in much less time than if the inspection covered all defects.

There is one weak point in the scheme which will require careful watching and prompt action. Where a road is directly responsible for the amount of damage done to cars on its tracks, a heavy increase in the monthly repairs is sure to call for an investigation by the operating department to ascertain the reason. It may be poor maintenance of track and switches or careless handling of cars by trainmen, and the remedy is forthcoming at once. But with roads in a pool of this kind, there may be unavoidable causes for any one road's expenditures for repairs uniformly exceeding its share of the total expense of the pool based on car mileage. On a mountain division, for example, the repairs per car-mile are usually greater than on a level division, and due allowances must be made for such physical conditions. It will take a careful analysis of the monthly reports of each road to determine whether disproportionate expenditures for repairs are due to careless train handling or other causes which might or might not be remedied.

It is the ultimate intention to standardize as far as possible all parts of cars belonging in the pool. This will result in saving a large amount of capital now invested in repair parts of many different designs which it is necessary to carry in stock. Repair parts for foreign cars will, of course, be kept on hand, but these will constitute only a small proportion of the material used in the shops.

AN ENGLISH ECONOMIST'S VIEW.

Mr. Acworth's letter to the *Statist* on the subject of railroad legislation in this country, printed in another column, is interesting because it is written by a thoroughly trained observer whose point of view has not been obstructed by the balancing back and forth of arguments during the last eight or nine months, and who grasps the topic in its entirety as he saw it at the time of the International Railway Congress, when the work of the Senate committee was practically concluded. Mr. Acworth says frankly that he is persuaded that government interference makes for higher rates and less public convenience, and in this he is in line with the great majority of American economists; but he qualifies his belief with a clear-sighted view of the political side of the question as opposed to the economic side. He finds, first of all, a certain railroad despotism in this country, and points out that one man dominates the great industrial region which centers in Pittsburg, while two other men dominate the development of the entire Pacific slope. Knowing the natural antipathy of the Anglo-Saxon race to despots and understanding clearly the way to get the kernel of American public opinion out of the surrounding shell and husks with which the newspapers cover it up and increase its apparent magnitude, Mr. Acworth questions whether the railroad interests are now adopting the wisest course in opposing the President. He believes that with the support of the railroad interests a good and moderate bill could be passed, while without that support there is some likelihood of a bill which will be neither good nor moderate, and if present legislation is staved off, he thinks such legislation is likely to come up again in a few years' time when the country, as he expresses it, "is less prosperous and worse tempered."

Mr. Acworth's letter is a reminder that in the heat of the controversy the great body of those who are opposed to Federal rate regulation have perhaps grown a little more radical on their own side of the argument than they were at the time of the President's message. The best opinion then was closely in line with Mr. Acworth's own, and advocated the passing of a moderate and conservative bill aimed at real ills and sighted so carefully that it would shoot where it was aimed; but the testimony brought out before the Senate committee has been so clear on one or two points, notably, that the inequalities of the present railroad situation are not those that a rate regulation bill is likely to correct, that it is probably safe to say that much of the same public sentiment which formerly favored a moderate bill is now opposed to any legislation. Probably the most compelling cause for this change of heart was the testimony furnished by shippers who were perfectly satisfied with the present system and who fully balanced with the weight of their testimony the original complainants under the leadership of Mr. E. P. Bacon. It was so evident that Mr. Bacon had run out of witnesses, and that he required time and special searching to find shippers who were advocating governmental supervision over rates, that the original arguments on this side of the question lost much of their force.

Mr. Acworth's position is almost exactly that which the *Railroad Gazette* first assumed; that it would be better to pass a harmless bill that was full of sound and fury, but signified nothing, than to wait for a Socialistic campaign to be organized with the railroads as a target. But the testimony has also brought out in great sharpness some of the real and grave evils of discrimination by means of private car lines, etc., that exist at the present time. Granting, then, Mr. Acworth's general position, which seems to be that a legislative vacuum is a dangerous thing and that if a wise railroad law is not constructed to fill the vacuum which at present exists, a folish one is sure to be—is it not right to urge, both from an economic standpoint and a political one, that all efforts be bent towards bringing into the purview of the law the recognized abuses of the present time? If these discriminations, arising not from secret rebates, but from open manipulation of the law, can be done away with, is there really any political need for an experiment with rate regulation? In the tone of the press throughout the country there is growing evidence that the public is being educated to an understanding of what Federal rate making means, just as it was educated to see the fallacies of the silver campaign.

STEEL PASSENGER CARS.

Elsewhere in this issue are illustrated four new types of steel passenger cars, three of them for electric lines and the fourth a steel underframe postal car for the Santa Fe. The first all-steel passenger cars to be put in actual service were, we believe, the side-entrance suburban cars on the Illinois Central, which were built in the early part of last year. These were designed almost simultaneously with the Gibbs type of cars, which are in use in the New York Subway, but they antedate them some months in being put in service. Last year, at the time Mr. William Forsyth read a paper on the subject of Steel Passenger Car Design before the Master Car Builders' Association, these two types were the only ones then developed. Within a year there have been built, a steel baggage car for the Erie, a steel postal car of somewhat similar design for the same road, a private car for an interurban road in the West, and the cars now illustrated in this issue for the first time. The New York Central has placed an order for 150 cars built entirely of steel, which will be used for suburban service within its electrified zone around New York City, and a number of other roads are working on designs for steel passenger cars, which will probably be built in an experimental way within a short time.

This introduction of the use of steel in pas-

senger car construction represents the most important and far-reaching improvement since the application of the vestibule platform some 15 or 20 years ago. It promises to revolutionize this branch of car work even more rapidly than it has changed the principles of freight car design, for there is the safety of human lives at stake, and not merely a question of saving a few dollars a year in repairs or by reason of less dead weight for a given carrying capacity. Pullman cars have long been considered as strong as it was possible to build cars of wood, but their strength is gained at the expense of excessive dead weight and high first cost, because of the heavy and complicated system of framing employed. Entirely aside from the danger of fire due to the use of wood in them, it is doubtful whether, with all their strength they could resist the shock of a collision with a steel car. The wooden cars originally designed for the New York Subway, many of which are still in use, were substantially built with heavy platform sills and reinforcement in the ends, but the disastrous collision last March at the time of the strike proved conclusively that the strength of such cars was no match for the strength of the steel cars in front and in the rear, neither of which were seriously damaged while the wooden car was crushed and broken in at both ends. Had the wooden car received the more severe shock of the actual collision there would probably have been little left of it.

In view of the facts brought to light by this collision, it is interesting to note that as yet most of the designs of steel cars for use on steam roads have been for postal and baggage cars. These cars in the front of the train usually suffer the most damage in case of a collision or derailment, because they are caught between the rear cars and the steel tender. The postal authorities have always insisted on having postal cars built as strong as possible, but, nevertheless, they almost invariably are telescoped more or less by the tender. If, then, these cars are built of steel and made as strong as the tender in front of them, the greatest damage in a collision will result to the first wooden car placed behind them in the train. It becomes a question of localizing the damage, and if the first cars are of steel and are followed by wooden cars filled with passengers, it is almost a foregone conclusion that there will be greater loss of life and injuries than if there were one or two weak cars ahead to absorb most of the shock. We commented on the make-up of excursion trains at the time of the collision of the Purdue Special at Indianapolis on October 31, 1903, and pointed out that the loss of life would probably have been much less had there been an empty baggage car at the head of the train. With strong steel baggage or postal cars ahead of the coaches the result of a collision or serious derailment could hardly be less disastrous. There is obviously one lesson to be drawn from a consideration of these facts, and that is that it is not safe to run steel and wooden cars mixed in the same train. The wooden cars are almost certain to sustain all the damage. It seems difficult, of course, to devise any plan whereby a gradual transformation from wooden to steel cars can be made without using them in mixed trains, but the fact remains that this should be avoided if possible. If the railroads are going to build all passenger cars of steel in the future they should be put in service as complete trains of such cars and kept separate as long, at least, as there are any of the old weak wooden cars still in use. A modern 65-ft. coach with strong framing and steel vestibule platforms might be able to stand the shock of a collision behind steel cars with some degree of safety, but the cars built 15 years ago and not equipped with vestibules, would be crushed like paper.

So far we have not mentioned the danger from fire. On electric roads, especially those running underground or equipped for third-rail operation, the danger from fire is greater than the danger from collision. The presence of high-potential electric current is far more likely to cause a fire after a collision or derailment than car stoves or lamps or hot coals scattered from the firebox of a locomotive. Any number of cases on steam roads might be cited, however, in which large loss of life occurred by the wreck taking fire, and the strongest wooden cars, when splintered by a wreck, will burn as fiercely as the weakest cars. There can be no question of the far greater safety of steel cars in this respect, for if there is no wood to burn there can be no fire.

DEFECTIVE REINFORCED CONCRETE DESIGN.

During the last two years the United Shoe Machinery Company, at Beverly, Mass., has erected a considerable plant of reinforced concrete construction. It is, we believe, the first instance in New England where this material has been used exclusively, in designing large buildings. The recent appearance of expansion and contraction cracks in the panels has aroused much interest and concern among those who are following the use of reinforced concrete in building shops and factories, and it has seemed profitable in the paper printed on another page, to study in some detail this specific case. In designing the construction of the plant, the Ransome system was used throughout, under the direction of E. L. Ransome, who was the consulting engineer for this part of the work. Frank M. Andrews, of Dayton, Ohio, was the architect, and the contractors were R. L. Fosburgh & Sons, of Boston. Architecturally these buildings present a fine appearance, being surmounted by a parapet of ornate design, which is carried several feet above the roof. The exterior surface was dressed by pneumatic hammers, and has the appearance of being built of gray sandstone, although so much of the vertical sides is taken up with windows, that the concrete walls (except at the lower part of the first story, and the upper part of the fourth story) do not show prominently.

The physical features of the surrounding land are well adapted to landscape gardening, and the grounds are being graded and put in order. Artificial ponds have been built by damming the river which will furnish an abundant water supply for all purposes except drinking, including toilet rooms, lavatories and numerous shower baths. When the whole work is completed, these buildings will have somewhat the appearance of being located in a beautiful private park. It is to the credit of the company that it has been willing to spend a considerable sum in beautifying the exterior surroundings, and making them so attractive both to their own employees and the occasional visitor. The buildings seem for the most part admirably adapted to their purpose, but there appear to have been certain defects of design and errors of construction which, in the light of experience gained here, will probably not be repeated elsewhere.

As at first planned, no provision was made for taking care of the expansion and contraction of the concrete due to changes of temperature, which in a mass so large is far too great to be ignored or neglected. As the work progressed it was found that a change in length of two inches or more in each of the main buildings might be expected, and it was proposed to allow for this by putting in expansion joints every hundred feet or so, to be filled with lead or zinc. Before these were ready, fibre board was ordered to be substituted, but this plan was abandoned, even after the material had been procured, and a single joint in the middle of the length of each main building was left open about two inches. The two parts of the building are entirely independent of each other, and have no rigid connection. There is thus a mass of concrete more than 260 ft. long, in which no opportunity for adjustment to varying temperatures is given, and there are certain to be developed severe strains under the inevitable changes of form these structures will experience. It will be interesting to observe whether, in a material so inelastic as concrete, this method of providing for expansion and contraction proves satisfactory. Experience thus far in structures of this kind, however, would seem to be against the advisability of building such a mass of concrete in one piece (whether with or without reinforcement with steel rods) without occasional joints or other means of relieving the strains certain to be produced by the climatic changes in our latitude.

There seems to have been also a serious defect in the design of the floors in that the reinforcement in each panel was all placed just above the lower surface, and transversely to the building; and its behavior plainly shows the need of reinforcement in the upper surface as well—at least where it passes over the girders. The use of reinforced concrete on a large scale being comparatively so recent, and its behavior under different conditions so little known from experience, every item of information concerning it is of unusual interest and value. Those engineers who have had much experience in this method of construction owe it to themselves and their profession to furnish to their brethren, through the technical press and otherwise, such facts bearing on its use in buildings as may come under their observation. Whether or not the design of these buildings proves satisfactory from an engineering point of view, can, of course, only be ascertained from experience; but it will be of interest and value to note future developments in the directions wherein these buildings are peculiar.

POSSIBLE FUEL ECONOMIES.

Few Government reports embody more valuable information to mechanical engineers than the preliminary report on the coal-testing plant at the St. Louis Exposition last year. The information is useful alike to railroads and to manufacturers, and

will be appreciated by motive power officials who have suffered by the variation in fuel used at various parts of the line or at different seasons. One of the most frequent questions asked the mechanical department on some roads, and often the most difficult to answer, is in regard to increased coal consumption, and, as a rule, railroads know little of the intrinsic value of the fuels used, and have even less control of the points of supply. To a layman, it seems like a simple proposition to select a coal of desirable quality and to adhere to it, but the difficulty lies in the latter part of the problem. Frequently the grates and front ends are no sooner adjusted to a certain grade of fuel than the purchasing department gives the information that there is a strike at the particular mine, and an entirely different kind of coal will have to be accepted; or the mines cannot produce the same grade and an inferior quality will be furnished, and when the reports are made up a month later, there is surprise and indignation expressed in the general office at the poor fuel record that the motive power department is making.

As an instance of this, a road in the Northwest was found to be making a much poorer fuel record on one of the divisions than for the year previously, and upon investigation it was learned that the first year a large proportion of the coal had been brought by boats from Pennsylvania, and in the second year this proportion had been much smaller, and the difference made up with Illinois coal. We find that in the St. Louis tests there were nearly 9½ lbs. of water evaporated per pound of dry Pennsylvania bituminous coal from and at 212 deg. Fahr., whereas the Illinois coals only averaged 7½ lbs. We do not say that these represent the mines actually drawn from in the experience above noted, but the tests show readily what might be expected under similar conditions.

As the St. Louis tests were all made by the same staff and with the same apparatus, the comparative results are particularly valuable. Where reports are sent in by different observers and have been tested in various types and makes of apparatus, it is always questionable whether they are strictly comparable. But all this is here eliminated and even the rate of combustion varied only between 15 and 25 lbs. per foot of grate surface per hour. The lowest evaporative ratio was 5.40, and the highest 10.30—almost 100 per cent. greater! This alone shows the futility of making comparisons of fuel records, unless the grade of fuel be definitely known. As might have been expected, the West Virginia coals gave the highest efficiency, and lignite from North Dakota the lowest. The Arkansas coals tested gave as great efficiencies as the Pennsylvania coals, and, in fact, they followed the West Virginia samples, which, we think, is likely to cause some surprise, although the Arkansas coals have been considered good steaming fuels. In all, 65 carload samples from 17 different states were tested, so that the results are by no means restricted to any one section.

A striking point in the chemical tests is the very close correspondence between the number of heat units contained in the various coals as determined by the Mahler bomb calorimeter, and as calculated from the ultimate analysis, in many cases the difference being less than one per cent. In these calculations the calorific values assigned to the heat generating elements were as follows:

	British thermal units.
Carbon	14,544
Hydrogen	62,028
Sulphur	4,050

It has often been customary to take these values at 14,500, 62,100 and 4,000, respectively, which are very close to the above figures. This agreement between the two methods of determination gives great confidence in the results as reported.

In view of the great interest recently taken in gas engines, the producer gas tests are very important. While at the present time there are no locomotives built to produce gas and burn it in the cylinders, yet many railroads have extensive manufacturing and repair shops, consuming annually quite a large amount of fuel. It is but a few years since anthracite alone was considered suitable for making gas for internal combustion engines, and the fact that almost any kind of fuel can now be used for this purpose, as demonstrated by the St. Louis tests, will, no doubt, give a new impetus to the gas engine industry. Even lignites are susceptible to this treatment, and furnish a horse-power for an hour with from 2 to 3 lbs. of coal. It is rather remarkable that the North Dakota lignite, which gave the least number of thermal units, produced the richest gas, or a gas having 188.5 units per cubic foot; the amount of gas produced per pound of coal consumed in the producer, was much less, however, than with the other fuels tested, but there was no doubt that an internal combustion engine could be readily operated by means of this gas. The West Virginia coals furnished a much weaker gas, but the quantity was three times as much, so that the power produced by the engine per pound of fuel consumed in the producer was from 2 to 3 times as great.

A very interesting comparison is made between the amounts of coal needed to produce an electrical horse-power by steam generation and used in a simple non-condensing engine, and that used for the internal combustion engine, through the intermediary of the gas producer. It must be remembered that the gas engine was of nominally 235 h.p. driving a 175 kw. generator, whereas the steam engine of 250 h.p. was connected to a 200 kw. dynamo, both using belt transmission. On the average, it was found that about 2½ times as much power was developed by the producer and gas engine, as by the boiler and steam engine, for equal quantities of the same fuel, and this proportion applies approximately to the 14 different pairs of tests made under both conditions. As the fuel bills are ordinarily the largest items in railroad expenses, any plan that will permit the use of gas engines would be attractive from this point of view. As at present developed, this would be feasible only by using gas engines to produce electric power, and equipping the road for electric traction. But when such large engines as this necessitates are considered, it is found that with modern refinements, a horse-power-hour can be obtained from 1½ to 2 lbs. of coal, when operated by steam, and while gas engines and plants are offered to produce a horse-power from one pound of coal, we do not call to mind any very large plants (meaning large from a railroad point of view) that are operated on this principle. There is little reason to doubt, however, that they will be forthcoming, and in such cases it is principally a question of density of traffic paying a sufficient interest on investment, which must be quite large for any trunk line. In large central stations, the horse-power produced from a pound of coal should be nearly twice as great with gas as with steam engines, and as the labor in either case is about the same, the saving in fuel would help to offset the interest on the increased investment due to the gas producers and engines. This investment cost would be quite high, as producers are fully as high in price as boilers, and gas engines are very much more expensive than steam engines, and it is this fact that is largely responsible for the slow introduction of internal combustion engines, especially where the price of coal is low. Where it can be had for 50 cents a ton, and there are a number of such localities in this country, the reduction in consumption by means of gas engines would represent about $2 per year per horse-power, and if the gas engine cost $20 per horse-power more than the steam engine, the saving would represent 10 per cent. on the increased investment. This would not always be sufficient to induce the extra first cost, especially as gas engines in large units are by no means as plentiful as steam engines, even where coal is from $2 to $3 per ton.

The extensive use of briquettes on locomotives in France makes these briquetting tests at St. Louis interesting. It was found that anthracite culm formed a briquette when combined with one-ninth its weight of West Virginia coking coal, consolidation being produced by hard pitch, that burned like a lump of hard coal, making but little flame. It seems as if this might point to a future use of the enormous culm piles which surround the anthracite mines, and which in many cases have little or no intrinsic fuel value as they now stand. The cost of making such briquettes is not stated, and this would be a very important part of the problem, but the price paid for large sizes of anthracite coal at the present time suggests the probability of a market for such briquettes at a fair price.

Taking the report as a whole, we find a great deal of information on the fuel question that will be exceedingly valuable to railroad officers, and it is recommended that it be given the study by them that it so richly deserves. The manufacturers and large fuel consumers are equally interested, and will no doubt profit from the facts and results placed so clearly before them in this publication. Great credit is due the officials of the Geological Survey, who planned and executed this work.

New York, Chicago & St. Louis.

The New York, Chicago & St. Louis is the "weak brother" of all the Vanderbilt roads, and in particular is the Lake Shore's poor relation. It was built simply to parallel this road and has never owned a mile of road outside of its line from Buffalo to Chicago. Incorporated in 1881, it was rapidly built, and late in October of the next year was put in operation. The Vanderbilts, through the Lake Shore, promptly bought control, paying 37 for the preferred and 17 for the common stock. In those days of constant rate disturbances, any new line which was part of a through route caused a great deal of apprehension as to its effect on the

general rate situation, and it was feared that the Nickel Plate would break up existing arrangements. In order to avoid this, the Vanderbilts made of it a free-for-all western connection at Buffalo in the hope, apparently, that it would act as a sort of trunk line safety valve. That is, instead of having it turn over all its traffic to the New York Central at Buffalo, it was announced that the new road would exchange freight with any eastern road provided it received its proportion of the *established* through rate. For the eastern lines terminating at Buffalo, this obviated the necessity which had up to this time existed, of building or acquiring, as the Erie had just done in 1882, their own Chicago connections, and this offer of the Nickel Plate was accepted and has been kept in force ever since by several of the roads with Buffalo terminals.

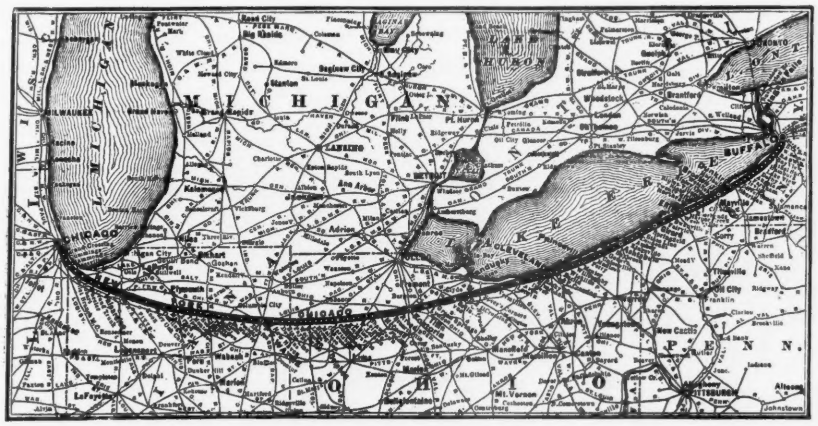
For some time after the road was opened, no through passenger trains were run beyond Cleveland in either direction. It soon appeared that it was actually without practical terminal facilities in Buffalo and Chicago and the results of the first year's operation made it clear that it was going to be no easy matter to earn the interest on the bonds. In 1885, default was made successively on the equipment, first-mortgage and second-mortgage bonds, and the road went into a receivership, which was terminated two years later by a reorganization at foreclosure sale. This reduced the capitalization (stock and bonds) from approximately $70,000,000 to $50,000,000.

As was remarked in the *Railroad Gazette* at the time the road was opened, it would have been better for all concerned if it had never been born. Better, that is, for everyone except the men who built it and a few owners of real estate acquired for right of way. In comparison with the present prices of railroad stocks, the price at which the Lake Shore bought control seems almost absurdly low; but even at 37 and 17 for the two classes of stock, the men who built the road were estimated at the time to have made some $10,000,000 out of their venture. Excluding their personal gains, the capital invested in the road was practically thrown away, because the Lake Shore was and is entirely able to carry all the traffic available; and if at any time it had not been able to do so, the cost of making any necessary improvements would have been very much less than the capital invested in the New York, Chicago & St. Louis.

Like most poor relations, the Nickel Plate can be prosperous only from the overflowing prosperity of its rich relative. So long as the Lake Shore can profitably carry additional traffic, the New York, Chicago & St. Louis will, in general, have to get along without it, so that its only hope for opulence is to have a time come when the Lake Shore is carrying all the traffic that it can handle, and any such time, there is little risk in saying, is some distance in the future. Yet if the weaker road cannot look forward for some time to a brilliant future, it has evidently already begun to enjoy reasonable prosperity. Gross earnings, which in 1886 (under the receivership) were $3,826,608 and in 1895 were $6,317,951, were $8,645,374 in the year ended Dec. 31, 1904. Net earnings similarly increased from $1,160,558 in 1886 to $1,807,228 in 1904, and in the latter year $1,070,758 was charged to expenses out of earnings, and, with the same mileage, maintenance of way expenses were nearly twice as great as in 1886. The actual difference between the two years in net earnings seems comparatively small; but, whether it looks large or not, in 1886 the company was in default and in the hands of a receiver, while last year it paid dividends of 5 per cent. on its $5,000,000 of first preferred and 3 per cent. on its $11,000,000 of second preferred stock.

At the time the road was built, glowing announcements were made of its superior construction, particularly in regard to bridges, but successive annual reports show that a large amount has had to be spent on the line, and especially on bridge work. For the five years from 1899 to 1904 there was an average appropriation from earnings of $218,000 a year for renewal and strengthening of bridges. The appropriation out of earnings for this purpose during 1904 was $396,291, and at the same time $314,600 was charged off earnings for improvements to roadway and structures. The road was for years sadly wanting in equipment. For example, no additions to equipment were made during 1897, 1898 or 1899, and in 1900 the only new equipment was five switching engines. Naturally the number of cars and locomotives in service was reduced year by year, while the amount expended for hire of freight cars in excess of the amount received from other railroads on the same account kept increasing, being $329,860 in 1897, $338,141 in 1898, and $361,079 in 1899. After 1896, it was not until 1901 that any new freight cars were ordered. During 1904, however, $359,870 was charged against earnings for equipment, which included an order for five hundred gondola cars for delivery in April and May of the present year. Compared with 1903, freight earnings increased $250,250 (3.5 per cent.), passenger earnings decreased $43,899 (3.28 per cent.), and gross earnings increased $197,055 (2.28 per cent.). The total surplus, including $38,917 added during the year, was $427,188. The New York, Chicago & St. Louis carried considerably more grain and mill products than anthracite and bituminous coal. Next after these two classes of traffic came iron and metal products. Although more passengers were carried and more tons of freight than in 1903, there was a total decrease of 176,375 miles in all classes of train mileage. The number of commutation passengers increased over 200 per cent., from 66,153 in 1903 to 181,680 in 1904, which shows that there must have been a great deal of new effort made to attract this class of travel.

On the whole, is is likely that it will be possible, in the unification of the Vanderbilt lines, to regularly turn over certain traffic to the Nickel Plate because it can most conveniently, in relation to the whole New York Central system, be handled there. Although it will probably be a long time before the road can be made worth its capitalization of $60,640 stock and $38,490 funded debt per mile, if the progress of the last few years is an example, the property will grow slowly but steadily more profitable.



New York, Chicago & St. Louis.

The Cincinnati Petition.

If the complaint of the Receivers and Shippers Association of Cincinnati is carried through to the Supreme Court of the United States one of two things must apparently happen. The court must either put by interpretation a judicial limit on the scope of the Anti-Trust law which is not clearly expressed in the law itself, or the railroad system of the country must be tremendously disarranged. After the original Northern Securities decision by a divided bench the Government announced loudly and plainly that it was not going to run amuck. The obvious weak point in this attitude was the apparent presumption that there were a large number of railroad companies which might find themselves in difficulties if the Government did care to run amuck, and that their safety lay in the forbearance of the Attorney-General rather than in the limitations to the scope of the statute. In the issue of April 29, 1904, we pointed out that the Government would probably not soon be called upon to decide whether it would have to prosecute another young Lochinvar out of the West or out of the East, but that it might sooner or later have to decide upon its procedure in the case of those ancient sinners against the Anti-Trust law whose turn would next come to be considered. The Anti-Trust law was passed in 1890. It needs no special study of the railroad situation to point out a large number of consolidations of competing lines that took place before the passage of this act. In the previous editorial we mentioned the relation of the Pennsylvania Company to the Pittsburg, Ft. Wayne & Chicago, and the P., C., C. & St. L.; also of the West Shore to the New York Central, and the Missouri Pacific to the Iron Mountain and the St. Louis Southwestern. Since 1890 the process has gone on continuously. The Southern Railway in 1894 purchased under foreclosure the Richmond & Danville and the East Tennessee, Virginia & Georgia; two roads that had jointly controlled the Alabama Great Southern. The Great Southern runs from Wauhatchie, Tenn., to Meridian, Miss., and elsewhere, and parallels the Southern Railway between these points. The complicated Rock Island holdings, dating from 1902, afford, in the relation of the Rock Island Company, the Chicago, Rock Island & Pacific Railroad, the Chicago, Rock Island & Pacific Railway and the St. Louis & San Francisco, another prominent example of an entanglement of consolidation and joint control of competing lines which the Supreme Court might or might not consider to be in restraint of trade.

The Northern Securities decision dealt

with a new combination. When the holding company was dissolved the net result was that control of the Northern Pacific was taken from Mr. Harriman and lodged with Mr. Hill. As we have previously said, the Supreme Court, no matter which way it decided this interesting case, had, in effect, to fortify a combination in restraint of trade, because in the supplemental suit to determine whether the stock should be taken out just as it was put in or whether it should be distributed pro rata, the court had either to give the Northern Pacific to the Union Pacific interests or to the Great Northern interests—there was no alternative. At the conclusion of this long and many-sided litigation the Supreme Court had only succeeded in demolishing one combination to build up another, for Mr. Hill did not have control of the Northern Pacific when he went into the Securities Company.

If the Supreme Court takes up this Cincinnati petition it will find a clear case of a railroad consolidation. Whether or not it will hold it to be analogous to the ruling laid down in the Northern Securities suit, is another matter. As seen by a layman, the fundamental difference in the status of the Northern Securities Company and the Southern Railway Company, for example, is that one was formed to hold the securities of a series of parallel roads physically distinct, while the other is a single railroad, diversified, but operated more or less as a unit. Whether the court would hold this to be enough of a difference to exempt the Southern Railway from the former ruling, must be a matter for conjecture. But the Cincinnati complainants go further than this; they ask whether a group of lines that come in to a common center under unified ownership do not possess the essentials that are described in the Sherman act as contracts or combinations in restraint of trade among the several states. The rulings here asked for are vastly broader than the rulings in the Northern Securities case, and if the matter is taken through the courts it may perhaps be determined whether the Anti-Trust act, like Tweedledum, is to hit everything in sight, or whether, like Tweedledee, it is to hit everything in reach, whether it can see it or not.

Northern Pacific Dynamometer Car.

The Northern Pacific dynamometer car, which is briefly described on another page, is the fifth such car to be built on the hydraulic principle. The originator of this type of car was Professor L. P. Breckenridge, of the University of Illinois, his first car having been built in 1878 for the joint use of the University and the Peoria & Eastern (Big Four) Railroad. Some changes were made in this car, however, before it was brought to the satisfactory working condition finally attained. It has lately been dismantled, the hydraulic cylinder not being large enough to absorb the drawbar pull of the present large locomotives. In 1900 a second car of larger capacity and embodying some further improvements was built for joint ownership by the Illinois Central and the University. The other two cars of the five above mentioned are those of the Burlington and the International Correspondence Schools. The care with which the principle was worked out at the start and the details of the mechanisms perfected is indicated by the fact that practically no important changes have been made in the later cars in the six or seven years since the first car was built. Apart from the apparatus, however, men using railroad dynamometer cars of whatever type agree that the cars themselves could be made much more comfortable and livable. The car is the home of the test crew, often for days at a time, and they are entitled to pleasanter quarters and better accommodations than are possible with a converted caboose or similar car. The test car might profitably be given some of the features of an officer's private car, such for instance as a suitable kitchen and dining room and ample and comfortable sleeping and toilet accommodations. Heating the car with steam from a Baker heater would also be much better than the caboose stove usually used. A feature of the Northern Pacific car which is regarded as an improvement is the elevation of the operating table to a position that will bring the man in charge to the level of the cupola, enabling him, if need be, to maintain a general survey of the movements of other members of the crew and to have a view of the track and surroundings. For night work, where the locomotive is not equipped with an electric headlight, it has been suggested that a headlight should be placed on the cupola of the car, to enable mile posts to be spotted and other features to be observed as in the day time. This would, of course, necessitate the provision of some source of electric power, the one suggested being an axle-driven generator.

The Master Mechanics' Association Committee report on shop layouts, and Mr. Geo. M. Basford's discussion on the Technical Education of Railroad Employees, both of which are printed in this week's paper, deal with two phases of a problem that is perhaps the most perplexing one just now being faced by motive power officers who are trying to put their departments on an up-to-date basis. After working for years to get new and modern shop facilities, they find themselves unable to produce the results they had hoped for, and they are the subject of criticism and official displeasure from the general manager and the directors. It is unfortunately true that many of the new shops on which millions of dollars have been spent in the last few years are not bringing in an adequate return on the investment in a saving in cost of repairs. The committee report points out that it requires a special knowledge of shop practice, very different from the knowledge of old methods, to get results out of modern shops, and that the men themselves and the foremen and higher officers have yet to acquire an intimate acquaintance with the innumerable details of operation and management that make for success. Also, that the new shops have not yet accumulated the many home-made labor saving tools and appliances that were thrown out with the rest of the old shop equipment. Mr. Basford goes deeper and asserts that the trouble lies in the lack of organization of the shop forces from the humble apprentice to the superintendent of motive power. With the passing of the old shop methods has gone the old shop training and the apprenticeship system that developed good mechanics from whom could be chosen competent foremen. He makes a plea for the re-establishment of systematic recruiting and training of shop apprentices, holding out to them a mental as well as manual training, and assuring them of a chance of advancement to permanent positions of responsibility. If the labor unions could be reconciled to the introduction of such a scheme as is proposed, it would undoubtedly prove successful in at least one respect, the establishment of an *esprit du corps* without which no complicated organization of men can be handled. Furthermore, it would develop young men into competent foremen—and the foremen in a shop are the vitally important members of its organization. Without good men in these positions the best equipped shop with good workmen and experienced superior officers, cannot be made to produce results, while a good foreman can get work out of poor men and old tools. Mr. Basford's plan is well worth careful consideration by the men who have an eye to the future, and it is to be hoped that it may have a trial on some road where the need is urgent and the entire success or complete failure will show in the shortest possible time.

Our attention has been called by the author, Mr. Samuel F. Prince, to a misstatement in his article, "A New Type of Four-Cylinder Balanced Compound," on page 637 of our issue of June 9. The article reads "a perfectly balanced locomotive could not be built with cylinders arranged in a horizontal plane unless a cranked axle or some other construction, mechanically unsatisfactory, was used." It should read "unless through other construction (mechanically unsatisfactory) than the cranked axle." The idea conveyed by the sentence as it was printed is the direct opposite of the author's meaning as is evident from the remainder of the paragraph. The error was due to the editor's misinterpretation of the wording in the original manuscript and to the fact that no proof could be submitted to the author for correction.

NEW PUBLICATIONS.

Descriptive Geometry for Students of Engineering. By James Ambrose Moyer, S.B., A.M., Instructor in Descriptive Geometry in Harvard University. New York: John Wiley & Sons, 1905. Octavo. VIII + 198 pages, 128 figures. Cloth, $2.00.

This volume is intended for a text book for teaching students of engineering and not for self-instruction. It attempts to use essentially the same notation as is used in mechanical drawing and the exercises are designed to illustrate the practical application of the subject. The data for the exercises are stated by the system of co-ordinates used in analytic geometry. Three planes of projection are used, viz.: Horizontal, front vertical, and side vertical. The four methods of making orthographic projections are explained, i.e., in the first, second, third, or fourth quadrant; but the method used in this book is the third quadrant, or the "glass box method," which is undoubtedly the best. In the fundamental problems given, the object which is to be drawn and the planes of projection are shown in a pictorial drawing, and alongside of this the projection drawing is given, which enables the student to understand the illustration at sight. The treatment is logical, beginning with the projection of a point, followed by the projections of a line, and then by the traces of a plane, and these are followed by the usual descriptive geometry problems. One of the good features of this volume, which is the second edition, is the 199 exercises which are given. Of the 198 pages, one-half are blank or only partly filled with figures, thus giving space in which the student may record some of his solutions. The method of treatment, the manner of illustrating, and the large number of practical exercises makes this volume well adapted to the teaching of descriptive geometry.

TRADE CATALOGUES.

Jet and Surface Condensers.—The W. H. Blake Steam Pump Co., of Hyde Park, Mass., has just published an attractive catalogue, No. 25, illustrating the jet and surface condensers manufactured by this company. These range in size from a horizontal jet condenser of 800 lbs. capacity in steam condensed per hour, up to one of 26,100 lbs.; while the twin simple and compound air pumps and jet condensers range in capacity from 8,700 lbs. of steam condensed per hour

to 135,000 lbs. Measured by the same standard the surface condensers with air and circulating pumps are built in sizes ranging from 4,100 lbs. to 40,000 lbs. capacity.

Machine Tools.—The Pratt & Whitney Co., New York, is distributing a novel souvenir mail card. The back of the card contains an illustration of the company's new 12-in. x 48-in. third milling machine. On raising the back, which is hinged, a pocket is disclosed containing a 10-leaf folder which describes the machine and illustrates the work which can be done on it.

Jacks.—The Duff Mfg. Co., Pittsburg, Pa., is distributing an attractive pamphlet, the cover of which is illuminated in gold and blue. A general description and illustration of the different types of jacks made by the company are given, and the various classes of work to which the jacks are applicable is clearly shown by illustrations distributed throughout the pamphlet.

The Victoria Falls Bridge.

The new bridge over the Zambesi river just below Victoria Falls, Central Africa, which was connected up on April 1, is one of the longest steel arch bridges in the world. It has a clear span of 500 ft. and crosses the gorge of the Zambesi just below the Falls, at a height of 420 ft. above the water. The Victoria Falls far surpass the Falls of Niagara in width, height and volume of water passing over them for the greater part of the year, and from this bridge a magnificent view of them is had. The bridge is one of the connecting links in the Cape-to-Cairo railroad, and is the most difficult piece of engineering which will be encountered. It is a parabolic, two-hinged, steel arch composed of two ribs spaced 27 ft. 6 in. apart at the crown and battered 1 in 8 in a vertical plane to give a width at the hinge bearings of 53 ft. 9 in. The arch has a rise of 90 ft. at the crown and is 105 ft. deep at the bearings, giving a depth of 15 ft. at the crown. Short truss spans bridge the space between the ends of the main arch and the edge of the gorge at the level of the surrounding plains. The bridge will carry two lines of rails. The foundations for the hinge bearings are built on ledges in the sides of the canon which is solid basaltic rock.

All of the material for the bridge was brought up from the south over the line of railroad already completed to the Falls. Before beginning the erection a cableway was stretched across the gorge over the site of the bridge, and this was used for transporting the material for the east half of the arch to the opposite side. It consisted of a 2¾ in. steel cable supported on a high tower at one end and a pair of shear legs at the other, and on this ran a self-contained electric travelling hoist taking power from a trolley strung alongside. A cage supported from the hoist was used for carrying men and supplies. The arch was built out from both ends and as no staging or falsework could be built up to the required height it was necessary to design the arch to withstand the strain of erection by anchoring the top chord. The method of anchoring was by boring two holes in the solid rock 30 ft. deep and 30 ft. apart and connecting them by a tunnel at the bottom. The anchor cables were attached to the top chords and then carried back and down one pit, through the tunnel and up in the other pit to the top, thus securing them to a mass of rock 30 ft. deep by 30 ft. wide. A travelling gantry crane was used in erecting the arches but the material was carried out to it by the cableway hoist.

The bridge was designed by Sir Douglas Fox and Sir Charles Metcalfe, Engineers for the Rhodesian Railway Company, and was built and erected by the Cleveland Bridge & Engineering Co., Darlington, England.

Friction Draft Gear.

BY R. H. BLACKALL.

The inception of friction draft gear dates back to 1888. The necessity for such a gear was demonstrated by the result of the extensive brake tests known as the Burlington tests. These tests showed conclusively that if the time was not already at hand when the friction draft gear was necessary the conditions of railroad service would soon make a better draft gear imperative. Little was done for some years other than to develop and patent a few gears, and it was not until the late nineties that the importance of such a device was generally recognized and a number of friction draft gears put into actual service. During the past six years approximately 150,000 cars have been equipped with friction draft gear; a large percentage, however, has been applied within the last three years. In the old days there was, comparatively, no necessity for the high capacity gear, and a single spring gear, with a capacity of about 20,000 lbs., was ample to meet the requirements of that day in which 10 and 11-ton cars carried a load of 20 tons. From the single spring gear, railroads went to the twin and tandem gear having a maximum capacity of about 40,000 lbs. As the weight of the cars approached 20 and 22 tons, the carrying capacity increased to 50 tons, and the hauling capacity of the locomotives increased correspondingly, the necessity for a gear of greater capacity manifested itself by unmistakable signs. At first it was thought necessary to increase the spring power only, since it was not realized until tests demonstrated the fact that while the greater spring capacity would take care of the buffing forces, equally bad effects would be introduced owing to the recoil of the spring. What was needed, and what has been obtained, is a friction draft gear containing a maximum amount of resistance with a minimum amount of recoil.

In designing draft gear there has been a tendency to obtain a maximum capacity while at the same time provision has not been made to accomplish a maximum amount of work. By examining indicator cards made with different draft gears it will be noted that the gear necessitating the greatest force to compress it solid does not necessarily represent the gear which will absorb the greatest number of foot pounds of energy. This result can only be obtained by a gear which will combine a reasonable travel with a high average pressure. This travel multiplied by the average power, as represented by the card, shows the actual work performed. If the frictional resistance builds up too fast, or if the travel of the gear is insufficient, the protection afforded is inadequate and will correspond to the elasticity in heavy timbers.

In selecting a gear it is essential to consider the possibility of wear. To reduce this to a minimum it is necessary to have a spring power that is sufficient to take care of the ordinary strains such as are produced after a train is in motion and the engine is working on the cut-off. This spring performs an important function also in regulating the amount of friction that is obtained from the gear. With no preliminary spring, or corresponding part to perform a similar office, the degree of friction produced is very uncertain and is likely to lead to irregular results as well as to greatly increase the tendency for the frictional surfaces to cut. Any effort which is constantly draft gear in the 1903 Proceedings of the Western Railway Club shows without doubt changing in intensity serves to wear the friction surfaces and decrease the life of the gear.

The report of the committee on friction that the single spring, twin spring and tandem spring gears, are inadequate to cope with the severe conditions which exist when a high power locomotive, or locomotives, are handling long trains of heavy capacity cars; this is especially true where light capacity cars of old construction are scattered through the train. It is no uncommon thing to see trains in transit in which the springs are entirely compressed for 10 or 15 cars back in the train. This means that any strain in excess of that already applied must be withstood by the underframing of the cars, and there is no opportunity to cushion sudden strains.

A recent occurrence on the Brilliant Cut-off of the P. R. R. is a fine illustration of the value of friction draft gear. Considering the speed, the small amount of damage done was remarkable. Ten loaded 100,000-lb. capacity steel cars running at a speed of 18 m.p.h. struck 20 loaded steel cars of equal capacity that were at rest. The shock was sufficient to rupture center plates and body bolsters and in three or four cases to bend end sills and bulge the side sills. Two of these cars were equipped with twin spring gear and the only three couplers broken were on these cars. No defects were found in the couplers, draft gears or draft lugs on the friction draft gear cars.

USES.

The use of friction draft gear, except in isolated cases, and until recently, has been confined to freight cars and tenders. No one appreciates, as does a railroad man, the annoyance of a train separation on a long passenger train; this is especially true if the trouble occurs between sleeping cars, and in such a place that it is necessary to change the passengers from one car to another. This occasional occurrence has led the Pullman Company to seek a means of avoiding recurrences of this nature, and they have decided to adopt friction draft gear as standard for all their cars. This practice has also been adopted by one of the largest trunk lines, and others, especially those handling long trains, will undoubtedly establish this practice as standard in the near future.

SPECIAL ADVANTAGES OF FRICTION DRAFT GEAR.

The following are the special advantages that may be obtained by the use of friction draft gear.

It affords a yielding resistance that accomplishes a protection to the couplers, car sills, and, in fact, to all parts of the car.

It dissipates shocks, thus tending to minimize failures and increase the car mileage.

The cost for repairs to draft gears is greatly reduced.

It greatly reduces the amount of recoil, even when compared with that obtained with the single spring gear.

Train separation is practically done away with.

The life of a car is increased by its use.

COST.

One of the reasons why there is not a more general use of friction draft gear is its initial cost; this, however, viewed from the standpoint of what it will eventually save, seems to be a false economy.

One of the most convincing arguments in favor of friction draft gear is the condition of the repair tracks on roads having cars equipped with both friction and spring gears. It is a surprise to walk through a yard and note the few friction gear cars that are in for draft gear and sill repairs, as compared with the number of spring gear cars of the

same construction aside from the draft gear, in for these defects.

When the saving in repairs, the additional mileage obtained from the cars, and the minimizing of train delays due to draft gear failures are considered, these benefits offset many times the original saving due to the application of spring gear cheaper in first cost.

In comparing the original cost of the two types of gears it is interesting to note that, almost invariably, the attachments, such as yokes, followers, draft lugs, etc., are figured for special strength with the friction gear while, with the spring gear, the corresponding material is very much lighter in construction. The results of a yard inspection show that it is the exception to see a steel car with spring gear on which the followers and draft lugs are not more or less bent. If material of equal strength were used with both types of gears the original cost would be much less in favor of the spring gear. In comparing the cost of different friction gears it is also important to use the same strength of attachments in connection with the gears considered. There is no part of a car in which the false economy will manifest itself more quickly than in the selection of an inferior draft gear.

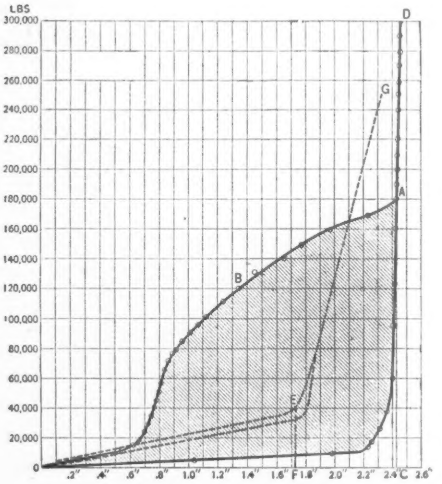
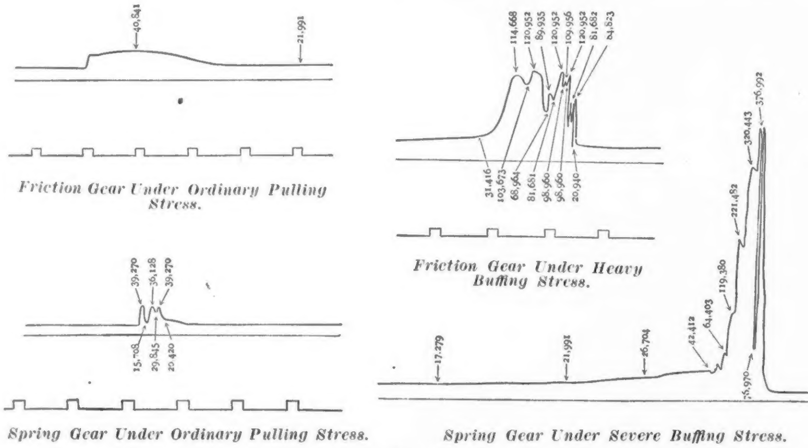


Fig. 1—Static Test of Spring and Friction Gear.


Friction Gear Under Ordinary Pulling Stress.

Friction Gear Under Heavy Buffing Stress.

Spring Gear Under Ordinary Pulling Stress.

Spring Gear Under Severe Buffing Stress.

Fig. 2.

THE EFFECT OF SPRING GEAR ON TRAIN SEPARATION WHEN USING THE BRAKES.

Little has been said touching the effect of spring gear in the handling of trains with air-brakes; the action of the springs plays a very important part in the undesirable results often obtained. There are trains with which no trouble whatever will be experienced if the brakes are handled in a certain manner at certain speeds. There is a critical speed, however, which, with the same trains, will produce break-in-twos, if the draft gear is not of sufficient strength to cope with the ordinary effects produced. This point is better understood when we consider the action of the slack in a long train. A gradual reduction of brake pipe pressure causes the brakes to apply slowly throughout the train, but the application of the front brakes first causes the slack to bunch and the draft springs to be compressed. As the brakes are applied on the rear of the train and the cylinder pressure becomes more nearly equal throughout, the tendency is for the springs to recoil, thus permitting the slack to run out. If a heavy reduction has been made, and this slack action takes place as the speed of the train approaches 6 m.p.h., when the friction between the shoes and the wheel is much greater than at faster speeds, the recoil of the springs is much more severe in its effects. The result is a severe tension which often takes place in the form of a jerk and which sometimes causes train separation. The reason why this does not occur more frequently is that the brakes are often still applying on the front portion when the train is brought to rest, with the result that the slack remains bunched. The weight of the train may be so distributed as to cause this same effect, due to the variation in braking power which results from difference in weight of cars and their contents.

A train of empty cars equipped with air-brakes may be broken in two if the speed is such that the slack runs out just before the train comes to rest.

An emergency application of the brakes often results in disastrous effects from buffing strains when the speed is slow. If an emergency application is made when the speed is high no objectionable buffing is experienced, but the danger lies in what may happen when the slack begins to run out, due to the recoil of the springs after the braking power equalizes throughout the train. If the speed is low when this takes place there is a strong likelihood that the train will be pulled apart if the draft gear is of insufficient strength or capacity. This is due to the fact that the higher braking power developed causes a more complete bunching of the slack, with the result that the slack settles with a corresponding intensity when it runs out.

If these conditions exist in trains of empty cars, a train of mixed cars with unequal loads presents a very interesting problem for the engineer, and one calling for considerable judgment as to just how the train should be handled to produce desirable results and such as can be taken care of by spring gear and old underframes. When a train of mixed freight has 10 or 15 empty cars on the rear end, the engineer faces a condition that requires the exercise of all his skill. A good friction draft gear meets such problems satisfactorily and practically does away with vexatious delays due to break-in-twos for which the engineer is often entirely blameless.

AMOUNT OF WORK ACCOMPLISHED BY FRICTION AND TWIN SPRING GEARS.

The diagram shown in Fig. 1 is a reproduction from the report of the M. C. B. Draft Gear Committee of tests made in 1902. These tests were made to determine the working limits of the riggings and the load at which any part of the gears might fail. The full line OBA represents the action of the Westinghouse gear under pulling or buffing stresses, starting with a compression of 2,000 lbs. and rising to a maximum of 180,000 lbs. at A, where the gear becomes solid after a movement of 2.42 inches. The total area, OBACO represents 18,399 foot-pounds, the work done in arresting the buffing or pulling stress, while the lightly shaded area between the compression and release lines represents 16,666 foot-pounds, the amount of energy absorbed and dissipated as heat by the friction gear. The shaded portion is 90 per cent. of the total area, OBACO, only 10 per cent. of the area being given back in recoil as shown by the non-shaded portion of the area OBACO. The line AD represents the attempt to find at what load any part of the gear might break. The limit of the testing machine, 300,000 lbs., was reached without any failure of the gear.

The dotted line represents, on the same scale, the operation of a modern twin spring gear. Starting from zero compression, the dotted line OE shows that the contraction of the spring is almost exactly proportional to the pressure applied until the limit of the gear, 40,000 lbs., is reached at E, at which point the springs become solid after a yoke movement of 1.73 in. From the point E to G is merely a test for a breaking load. The area OEF represents the work done upon the springs during compression, and the area between the dotted compression and release lines represents partly the amount of energy dissipated in frictional heating of the springs, and partly a weakening of the springs due to the fact that the load was gradually increased after the springs were solid at 40,000 lbs., until it reached 80,000 lbs., before release was made. The diagram shows in a striking manner the difference in the maximum capacities of the two gears, that of the friction being 180,000 and that of the spring being 40,000 lbs. The reactive effect is also clearly shown, that of the friction gear being but 6,900 while that of the spring gear was 16,000 lbs.

The action of the two types of gears is very clearly shown in Fig. 2. The cards themselves show perfectly the action that may be expected, and the smoothness of action is shown clearly by the line drawn by the indicator pencil. It will be noted that there is a much less tendency for sharp peaks in the cards made by the friction draft gear.

In the accompanying indicator cards, Fig. 3, are the results of some tests made to determine the effects that would be produced with an emergency application of the brakes if a train were equipped with but 50 per cent. of air-brakes, this being the minimum number allowable according to the ruling of the Interstate Commerce Commission. The effects of applying the emergency application with this make-up of train, when equipped with spring gear, are well known. In these tests with a friction draft gear

train, no damage whatever was done and the results were entirely satisfactory. The dynamometer car in each test was the 26th in a train of 51 cars. The tests comprised emergency stops at speeds of 6, 10 and 20 miles per hour.

The diagrams show clearly and conclusively that spring gears would not be able to cope with the severe strains imposed in this extremely rough service. The excessive strains shown are very much less than would be the case with a train equipped with spring gear, in which case there would have been no friction element in the draft gear to dissipate the buffing effort due to the rear end running into the front portion of the train.

This is a fine example of the protection afforded by the use of friction draft gear, and there seems to be no reasonable doubt but that damage would have resulted were it not for the friction element which reduced the shock to a minimum. In the tests made there was not a single case of failure.

In the indicator cards shown it will be noted on four of the diagrams that the maximum capacity was obtained with the indicator springs as used. The shocks shown in these cases were exceeded, but to what extent cannot be told.

In three of these diagrams it will be noted that the fluctuations are wider apart and more marked, this being due to the fact that the paper was being passed through the machine at a faster speed. The rapid vibration shown by the marks on the indicator diagram do not mean that there was a recoil. This should be accounted for by the vibration of the liquid in dynamometer cylinder since after the slack once ran in it remained bunched and there was a severe quiver throughout the dynamometer car which lasted until the train came to a standstill. The whole car was subjected to a continuous vibration resembling, but to a more marked degree, the chatter of a brake-shoe sometimes resulting from a brake application. The fluctuation in the tension line was undoubtedly due to this same vibration.

COMPARATIVE RESULTS OF TWIN AND FRICTION GEARS IN SERVICE.

The following table shows comparative results obtained with twin spring and friction and draft gear cars. These records were made from cars in regular service from Nov. 1, 1900, to Nov. 1, 1901. The cars were the same in construction aside from the draft gear.

1900.	Failures.		Car mileage		Ratio of mileage.
	Twin spring.	F. D. G.	Twin spring.	F. D. G.	Twin spring. F. D. G.
November...	18	0	14,455	149,820	1 : 10.3
December...	20	1	17,183	146,040	1 : 8.4(a)
1901.					
January....	18	0	22,356	139,800	1 : 6.2
February...	10	0	13,263	97,380	1 : 7.3
March......	13	1	11,637	131,640	1 : 11.3(b)
April......	11	1	15,535	149,220	1 : 9.6
May........	6	1	24,973	185,597	1 : 7.4
June.......	13	4	24,017	176,948	1 : 7.3(*)
July.......	7	0	22,750	147,839	1 : 6.4
August	5	3	22,854	149,203	1 : 6.5
September..	10	2	23,432	134,408	1 : 5.7(*)
October....	3	1	17,276	110,732	1 : 6.4(*)
Total ..	134	14	229,731	1,718,627	1 : 7.5

(a) Three F. D. G. and three twin spring cars had sills damaged in a collision and two of the latter had couplers broken.
(b) Friction draft-gear cylinder found cracked two weeks earlier.
(*) One F. D. G. coupler with 5-inch shank.

The average monthly mileage of the twin spring steel cars was 19,144 miles, while that of the friction gear steel cars was 143,219, or 7.5 times as great.

Cause.	Breakages of— Twin spring cars.	F. D. G. cars.
Broken couplers	52	12
Cracked couplers	1	1
Broken knuckles	49	1
Broken yokes	27	0
Broken followers	2	0
Broken lugs	2	0
Broken springs	1	0
Total	134	14

Not considering the broken yokes since the spring gear cars were equipped with yokes with a section slightly less in area, the failures were 107 to 14. Making due allowance for the mileage of the friction draft gear cars being 7.6 that of the twin spring cars the failures are 57 times greater on the spring gear cars.

Friction gear to twin spring car failures..1 to 72
" " coupler failures.........1 to 31.7
" " knuckle failures.........1 to 368

Tests made by members, and reported on at the Western Railway Club, showed that under average treatment the strains obtained in trains approximate 50,000 lbs. in tension, buffs 80,000 to 100,000 lbs.; with fairly rough treatment the tensions are 100,000 and the buffs from 150,000 to 300,000 lbs. In rough treatment the buffs run much higher than this, and it was the opinion of the committee that the gear and underframing should be designed to withstand buffs of 500,000 and tensile stresses of 150,000 lbs.

From these tests there seems to be little ground for the plea recently advanced that friction draft gear is a fad. The fact that on a large percentage of the great number of cars ordered this year friction draft gear was specified, proves conclusively that it is not a fad idea. Friction draft gear is a necessity and it is here to stay.

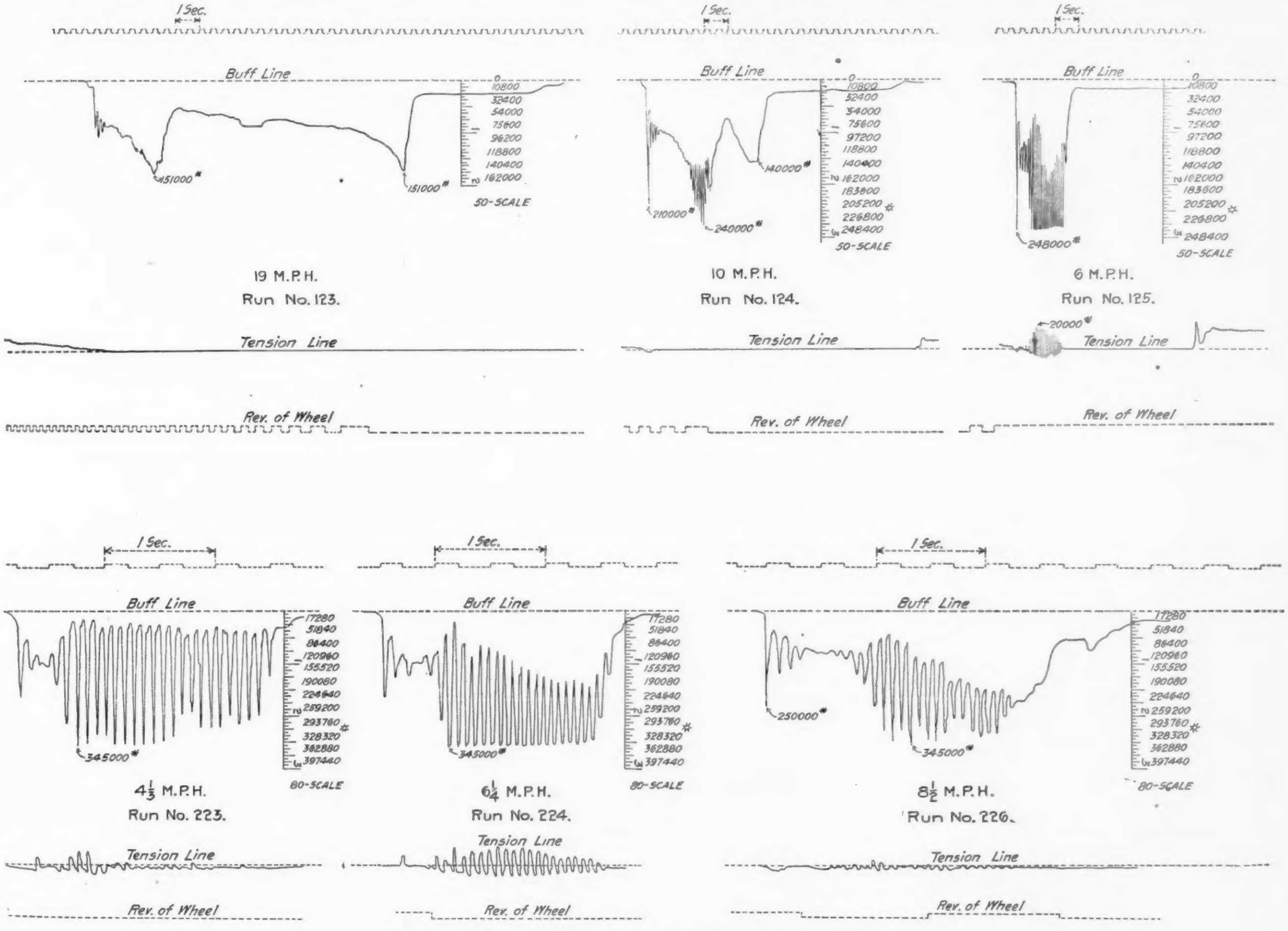


Fig. 3—Dynamometer Tests of Friction Draft Gear.

Steel Underframe Postal Car for the Santa Fe.

The Atchison, Topeka & Santa Fe is building some steel underframe standard 60-ft. postal cars, the design of which is shown in the accompanying drawings. There will be 39 cars in the lot, intended to supersede the present all-wood cars, which will be converted into baggage cars. The plans for the new postal cars have been approved by Government officials.

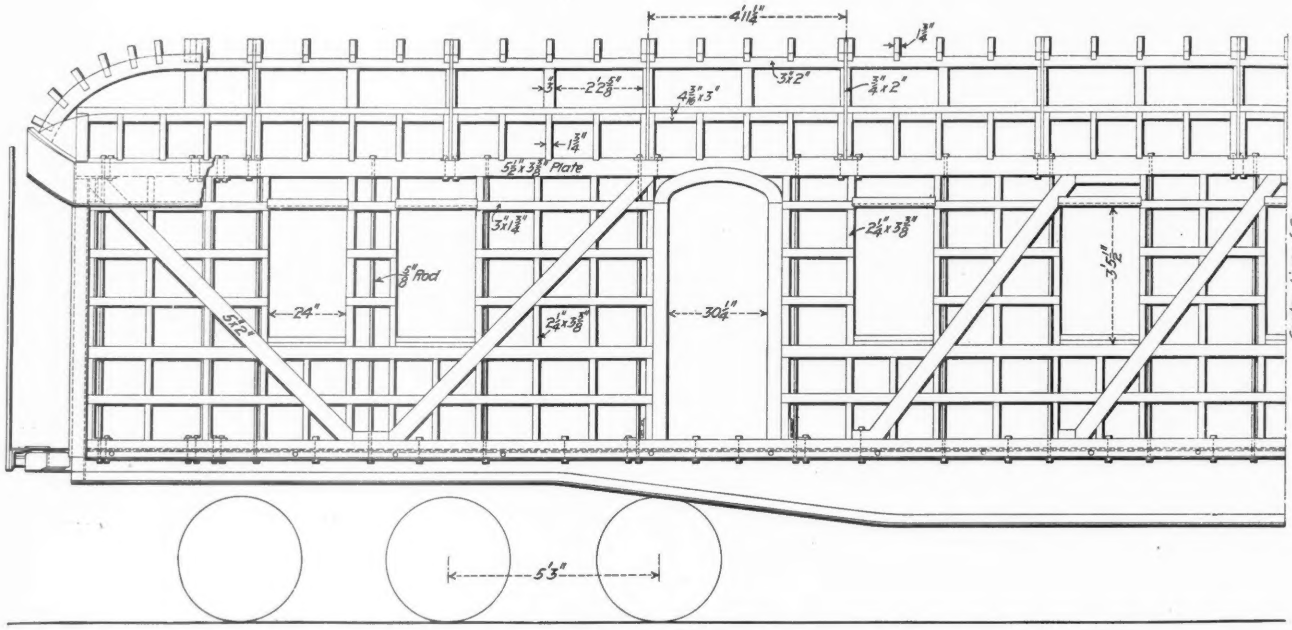
There are two center and two side sills, all four being fish-belly girders. The center sills are 24 in. deep at the middle and 13 in. at the ends, and the side sills are 23 in. at the middle and 10⅛ in. at the ends. A steel cover plate ¼ in. x 24 in. x 59 ft. 8 in. is riveted to the tops of the center sills. The four sills are tied transversely by pressed steel diaphragms ¼ in. thick and 11¾ in. deep, riveted to the sills. These cross-ties are stiffened at the bottom by a ¼-in. x 6-in. plate 5 ft. 11 in. long, which passes through openings cut in the webs of the center sills, and is riveted to the bottom of the diaphragms by ⅝-in. rivets. There are eight of these cross-ties. Midway between the center and side sills and parallel to them are sections of 5-in., 6½-lb. channel riveted to the cross-tie diaphragms. They run the length of the car, furnishing a continuous intermediate support for the floor.

A detail of the end-sill and buffer beam is shown. As shown in the section through the center, the webs and top flanges of the center sills are cut away at the ends to a depth of 6 in. and a distance back such that a 6-in., 10½-lb. channel secured across the ends of the longitudinal sills, flanges in, has its back 11 in. from the end of the center sill. The end-sill is made up of this member and a bent 6-in., 8-lb. channel with the middle or parallel part 4 ft. 10 in. long and 7 in. from the first, with four diaphragms between, two of which are in line with the center sill webs. Both channels are under, and are riveted to, the center sill steel cover plate. The ends of the outer channel bend back to meet those of the inner channel at the side sills. To the front of the end sill is secured a heavy cast-steel buffer beam of special form, as shown in the drawings. The construction is such that the buffing shocks come directly on the center sills. The wooden sill for attaching the end framing is secured to a 2½-in. x 2½-in. x $^5/_{16}$-in. angle riveted across the tops of the longitudinal sills back of the end sill.

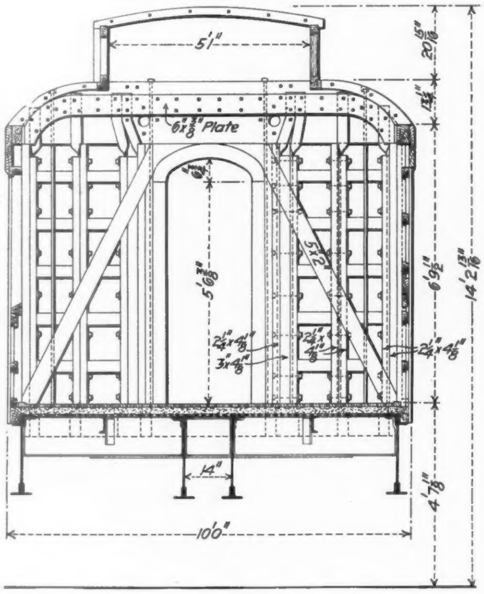
The body bolster is formed of two sets of pressed steel diaphragms ⅜ in. thick. They are riveted to the side and center sills, with flanges outward, the distance between them, back to back, being 3 ft. 6 in. Each set is strengthened at the bottom similarly to the cross-ties, except that the plates widen out at the middle to 8 in., where they are riveted to the center sills. The top of the bolster is a cover-plate ¼ in. x 4 ft. 3 in. x 8 ft. 11½ in., riveted to the tops of the diaphragms and the center and side sills by ¾-in. rivets. The cast-steel center plate is riveted to the center sills with ⅞-in. rivets. Each side-bearing is a hardened steel plate riveted to the bottom flange of a 7-in., 9¾-lb. channel and the bottom leg of a 3-in. x 3-in. x ¼-in. angle riveted to the back of the channel; the channel extending between the diaphragms forming the two sides of the bolster, and riveted to the latter and the cover plate.

The portion of the underframe not occupied by cover plates is covered with ⅛-in. steel plate, riveted to the sills, cross-ties, etc., and forming a sub-floor. Transverse wooden nailing strips, 2¼ in. x 2¾ in., are bolted to the sub-floor by ½-in. carriage bolts, the ends of which are riveted over the nuts. Yellow pine flooring, ⅞ in. thick, is nailed to these, and the space between it and the sub-floor is packed with mineral wool.

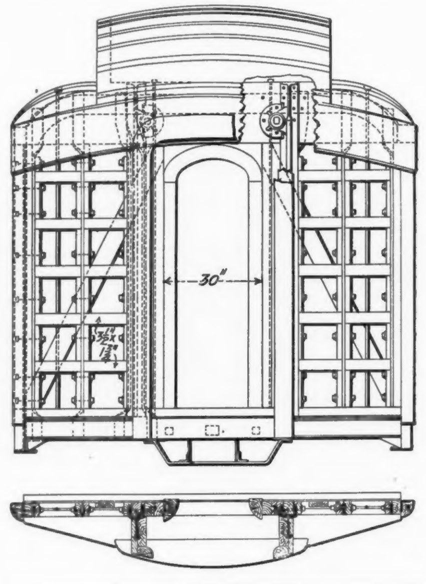
Details of the body frame are shown, the



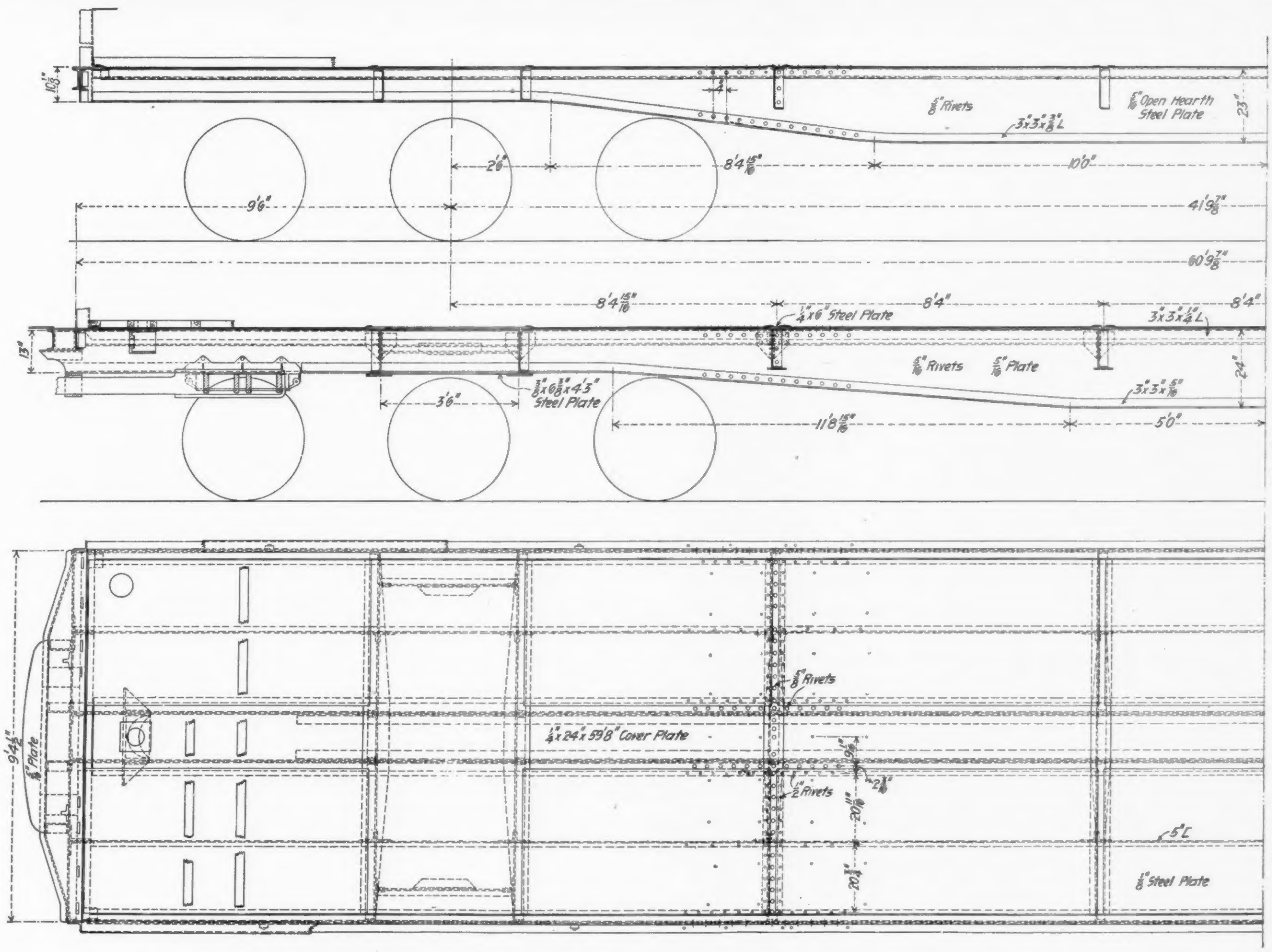
Side Framing for Steel Underframe Postal Car—Atchison, Topeka & Santa Fe.



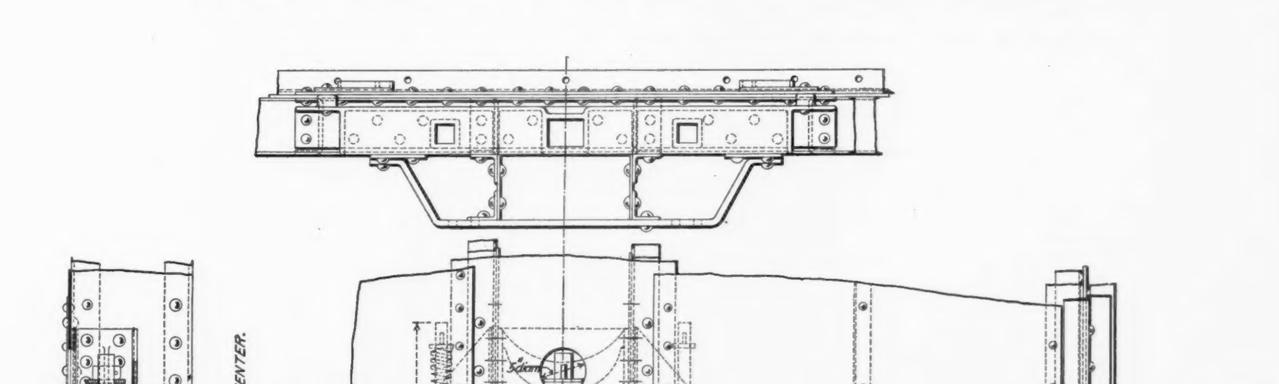
Cross-Section.



End Elevation.



Details of Underframing for Steel Underframe Postal Car—Atchison, Topeka & Santa Fe.

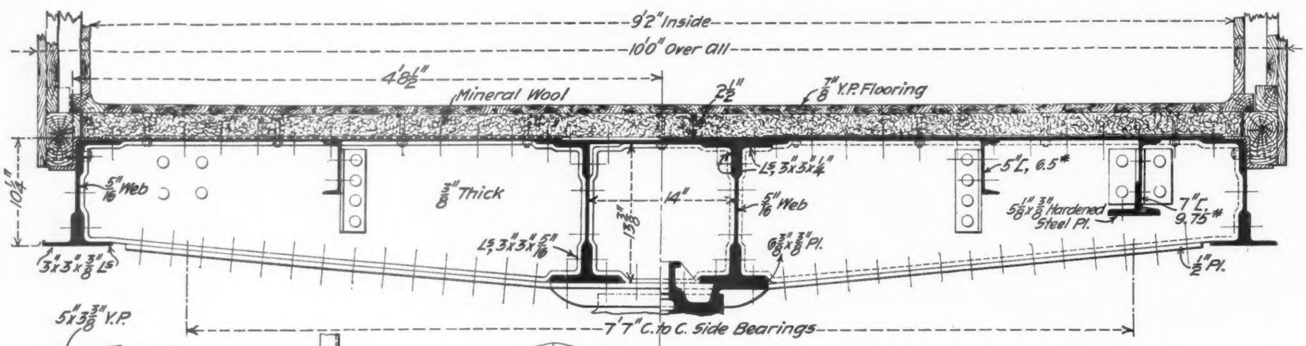


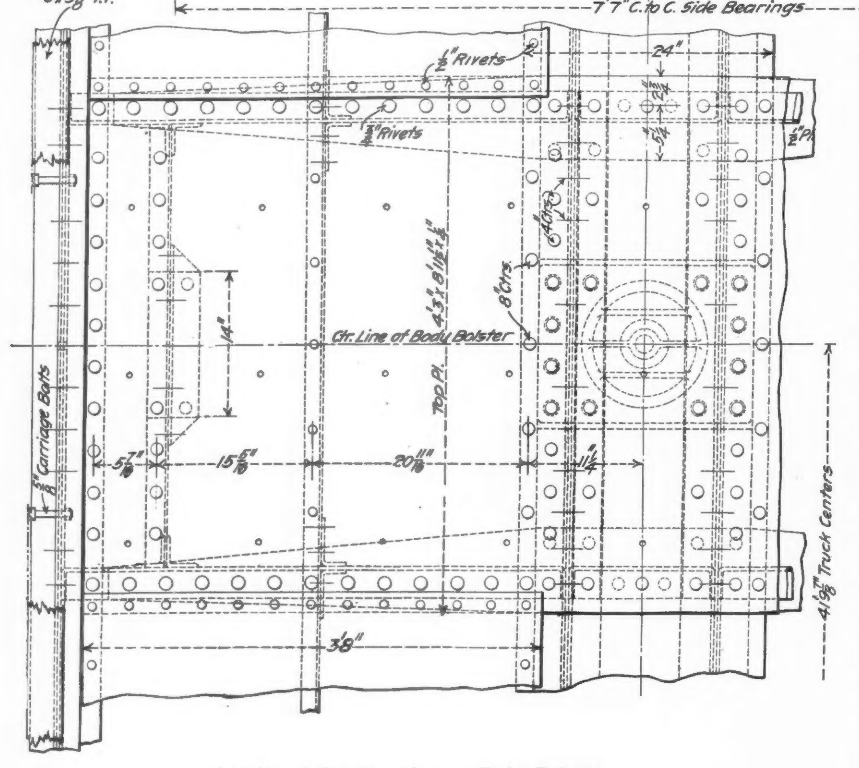
Details of End Sill and Buffer Beam Construction.

end framing involving the principal features of difference from standard Santa Fe practice for all-wood cars. A composite framing is used, the posts being plated in a manner similar to the practice of the Vanderbilt lines. There are two plates in the end frame post, and one each in the end stud and corner post. The latter is further reinforced by a 4-in. x 3-in. x $^5/_{16}$-in. angle. The vestibule frame is reinforced by a 7-in. deck beam on each side. The side and end framing is fitted with sectional blocking throughout.

The estimated weight of a car is about 105,000 lbs., fully equipped. They are mounted on Santa Fe standard six-wheel trucks with 5-in. x 9-in. journals, and are equipped with Miner draft rigging and National couplers.

We are indebted to Mr. Lovell, Superintendent of Motive Power, for the drawings.





Details of Construction at Body Bolster.

The statement is made that heretofore even through freight trains in Russia have stopped at all stations, and waited a prescribed time, whether or not they had freight to leave or take. This in a country where there are solid train-loads to be hauled hundreds of miles, as to Chicago or Duluth. It is announced as a novelty that recently on certain lines through freight trains have been run scheduled to stop only at water stations and the like, with great economy in rolling stock.

Expansion and Contraction Cracks in a Reinforced-Concrete Structure.

BY GEORGE W. BLODGETT.

A recent example of the extensive use of concrete-steel construction is found in the new shops of the United Shoe Machinery Company, which has erected a group of six buildings, covering the greater part of a tract of land equivalent to an area of more than 525 ft. square, near Beverly, Mass., for the manufacture of light shoe machinery. These buildings are substantially completed, and are partly fitted with machinery, which is being installed as rapidly as possible.

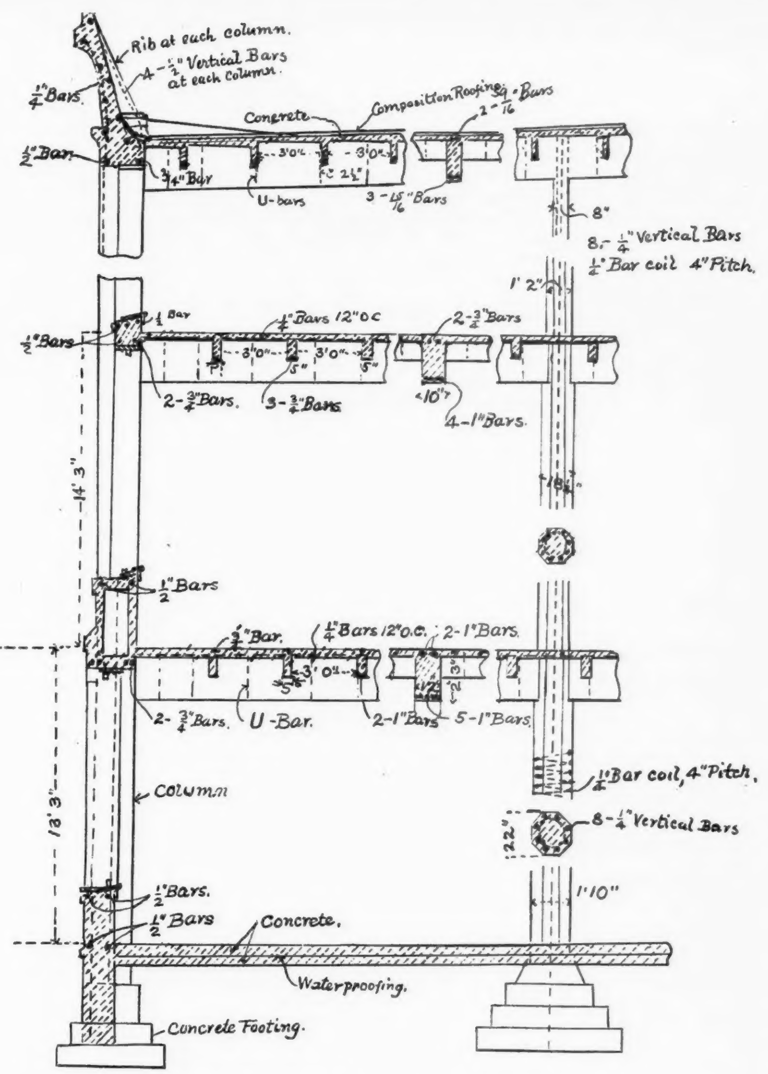
The two principal buildings are 531 ft. 10 in. long and 61 ft. 10 in. wide, over all, and four stories high. These are to be used for machine shops. Two other buildings of the same width are placed with their ends opposite each other, and are united by a one-story building used for a lavatory, etc.; the combined area of these three buildings being equal to that of one of the two machine shops. One of these is 281 ft. 10 in. long and is to be used for a forge shop, and the other, 196 ft. long, for a storehouse. A foundry 221 ft. 10 in. long by 108 ft. 10 in. wide, and an electric power-house 98 ft. 9 in. long by 91 ft. 9 in. wide completes the group. The power plant furnishes a direct current for driving all the machinery in the other buildings. The shafting on each floor is suspended from hangers bolted to the ceiling and is arranged in sections, of lengths varying according to the work to be done, the largest being more than 100 ft. long. Each section is driven by a belt from a 500-volt motor hung by brackets from the ceiling and controlled by a switch and starting box on a post nearby, at a convenient height from the floor. The power house is of but one story, and is divided longitudinally by a wall extending from the floor to the roof into two unequal portions, the larger of which contains four boilers of about 250 h.p. each; the other portion of this building extends about 8 ft. below the level of the boiler-room floor, and contains two electric generators of 250 k.w. each, operated by General Electric steam turbines.

The buildings are built almost entirely of concrete reinforced by steel rods. The main buildings are divided by four longitudinal rows of columns with 27 columns in each row, into 26 panels substantially alike, each containing three sections about 20 ft. square. These columns rest on independent foundations 6 ft. square, which are supported by footings about 5 ft. deep, made of pure concrete mixed in the proportions of 1:3:7½.

The exterior walls of these buildings are mostly glass, windows, which occupy about 70 per cent. of the surface, consequently there is almost no available wall space by which to support any of the weight, all of which therefore above the window-sills of the first story is carried by the columns. The portion of the walls below the windows of this floor is designed as a girder, and reinforced by steel rods in both upper and lower edges.

The first story floors were built after the columns, but above this point the work at each floor level was carried on continuously, and the whole of the construction, beams, girders, floor panels, etc., are monolithic. The columns at the walls are rectangular in section, and on one side are made hollow to contain the flues for heating and ventilating the buildings. These columns are reinforced by four vertical rods of ⅜-in. diameter, which are continuous from the basement to above the parapet. They are tied together diagonally by ¼-in. horizontal bars 2 ft. apart vertically.

The interior columns are substantially alike, and are of octagonal cross-section, the size varying according to the load they have to sustain, from 8 in. diameter on the fourth floor, to 14 in. on the third floor, 18¼ in. on the second floor, and 22 in. on the first floor. Each column is reinforced by eight ¼ in. bars set vertically in the angles close to the surface, and further strengthened by coils of twisted steel rods ¼ in. in diameter with 4-in. vertical pitch, placed just inside and tangent to the vertical rods. These rods are lapped 12 in. in each story and spliced by enclosing them in sleeves 12 in. long made by coiling closely steel bars of ¼-in.



Sketch of Repairs to a Reinforced Concrete Floor.

x ⅛-in. section. All the vertical rods are spliced in one-story lengths in the same manner.

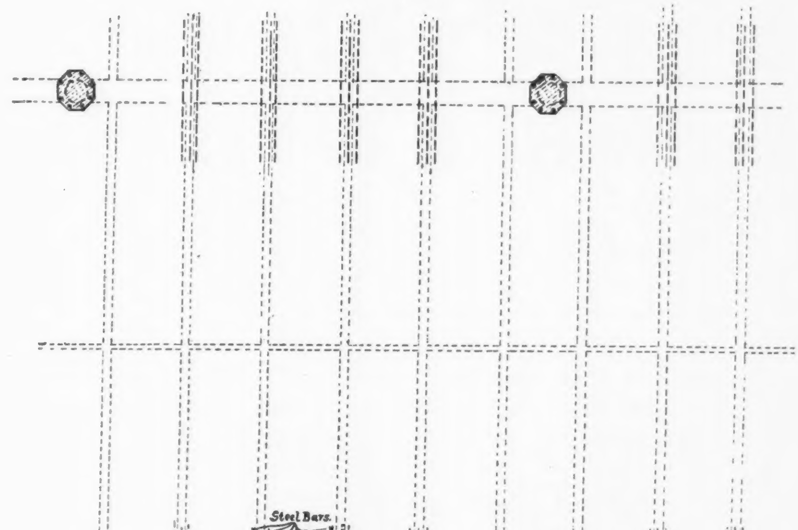
On the top of each concrete post at each floor level is moulded a section which projects far enough beyond the post proper to form a sort of bracket sufficient to serve for connection with the girders and beams which run from each post to the next and carry the weight of the floors. The vertical rods pass through these concrete blocks and bind together the top, bottom and middle sections of each column, which are united also at each floor level with the floor panels, beams and girders, to form a monolithic construction with the walls, which were carried up at the same time. The first floor was built for the most part on rolled earth, and consists of a layer of concrete 4 in. thick, then a waterproofing layer covered with 6 in. of concrete troweled smooth on the upper surface.

The second floor is designed for a live load of 250 lbs. per sq. ft., while the third and fourth floors are proportioned for 200 lbs. live load per sq. ft., and the roof for 75 lbs. The floors are generally supported by transverse girders 12 in. x 27 in., which, on the second floor, are reinforced by five steel rods 1 in. diameter in the lower edge, to provide for the tensile stress, and two 1-in. compression bars in the upper edge. On the third floor the girders are 10 in. wide, and have four 1-in. rods in the lower edge and two ¾ in. bars in the upper edge; the fourth floor girders have three bars $^{15}/_{16}$ in. diameter in the lower edge, and two $^{9}/_{16}$-in. bars in the upper edge of each. Between these girders floor beams are placed about 3 ft. apart (each span of 20 ft. usually having six 5-in. x 15-in. beams), which are 20 ft. long and are united in the center by a small beam or stiffener running transversely to them.

The floors are made in panels 20 ft. sq., and were laid in the following manner: The floor beams and girders were made in moulds of suitable size, sufficient in number to build the whole of a floor at once. These were all placed in position and supported partly on the columns of the story below (which had been previously built and allowed to harden sufficiently to carry the weight without danger of collapse or deformation), and partly on falsework set up between the columns. The steel rods for the girders, beams and floor panels were then placed in their proper positions and securely fastened so as not to be displaced by the concrete as it was being laid. Construction then began at one end, and the columns, girders and beams were built at the same time with the floor panels, so that each floor is united to the columns which support it, and to the walls. The moulds for the beams and girders were rounded at the top, where they joined the floor panels with a 2 in. radius, and the bottom edges were chamfered (by placing a small fillet in the mould), so as everywhere to avoid sharp corners in the concrete.

Great care has been taken in all the construction to curve the angles at the surfaces of all parts which might be liable to abrasion or fracture, or might produce excessive strains in shrinkage.

Some of the concrete was laid in freezing weather, and to prevent injury by frost, the building was enclosed by sail cloth or canvas on the sides and at the top, and several braziers were placed on each floor, and in these fires were maintained, to keep the temperature above freezing. In the coldest weather, however, this was not sufficient, and the work had to be suspended at times, but was continued most of the winter by warming the materials, mixing with salt



Steel Bars Inserted to Strengthen Floor.

water, covering the concrete as soon as laid, etc. The concrete for the columns and walls was made in the proportions of one part Lehigh or Atlas Portland cement to two parts sand and five of screened gravel, of sizes varying from ¼ in. to 1 in. diameter. For the floors the proportions were 1:2:4. All the concrete was made very wet, and shoveled into the moulds, then rolled or thoroughly rammed into place except where sufficiently consolidated by falling 10 ft. or more.

One of the most interesting parts of this work was the construction of a chimney 142 ft. high, of reinforced concrete, built without scaffolding, the falsework in the interior serving the purpose. This is built with an inner shell in the lower part 4 in. thick and an outer shell 5 in. thick, reinforced with vertical rods and horizontal rings.

As originally designed, no provision was made for expansion and contraction of the concrete, but as it was calculated there would be a difference of approximately 2 in. in the length of each of the main buildings due to the changes of temperature during the different seasons, some means of allowing for this had to be devised.

This was finally done by leaving an open joint in the walls, floors and roof at the center of each building, which is thus divided into two portions each about 260 ft. long. This space of 2 in. in the floors is covered by steel plates bolted to the girder on one side, and sliding freely over the surface of the other. On the roof the plates are bent so as to form a close joint of such a shape as to exclude the moisture and prevent the escape of the heated air in the rooms below. In the divided wall columns which form the supports for the floors at this point the opening is closed by vertical wooden strips 6 in. wide bolted to each other through the columns, and sliding in grooves 8 in. wide, left for that purpose.

When the buildings were nearly completed and the heating apparatus installed, the temperature was kept quite high for some time, thus producing nearly the maximum expansion. After the heat was shut off and the buildings cooled, many shrinkage cracks developed, which are more noticeable in the floors than elsewhere, and run irregularly in nearly all directions, but do not appear to be important except as showing the need of better provision for the expansion and contraction that produced them.

After the floors were laid, and before they were used, cracks of varying width and depth appeared in the upper surface of nearly every panel in each story above the first, running somewhat irregularly, but following a course in general parallel to the transverse girders and at a distance of from approximately 1 ft. to about 2 ft. distant from the face of the girder below. Many of these ran in nearly a straight line, others followed a course more or less irregular, and sometimes at a greater distance from the girders, than that mentioned above. From a somewhat careful examination of these cracks and study of the conditions existing, there is little reason to doubt that they are due to the consecutive panels of the monolithic floor acting in the direction longitudinally of the buildings in a manner analogous to that of a continuous girder running over several piers (represented in this case by the transverse girders which support the floors). The moment of flexure in the upper surface of each floor panel therefore changes from compression in the middle to tension over the girders, and it is evidently at or near the point where this change in the direction of the stress occurs that the cracks appeared.

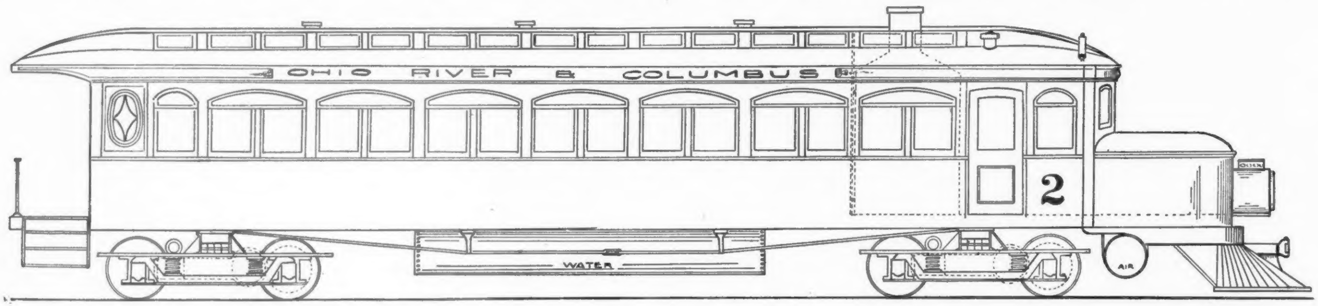
The steel reinforcement being just above the lower surface of the floor panels, there was nothing but the tensile strength of the concrete to resist this stress in the upper surface, and it is apparent that this was insufficient. It might have been expected that the cracks would occur over the center of each girder, instead of a short distance from the side, but the reinforcement rods of the floor panels being lapped over the girders, and the floor panels being moulded into one piece with the girders probably strengthened the construction so that the center over the girder was not the weakest point.

The diagrams show that on the second floor a ¾-in. rod was placed near the upper surface of each floor beam which is capable of resisting a considerable tensile stress, and on this floor the cracks do not appear to have been so serious as on the upper floors, where repairs were found necessary. Also this floor is thicker than those above. No accurate information can be obtained from the company as to the details of the repairs which were made, but they appear to have been done by excavating channels about 1 ft. wide over part of the floor beams in each panel, and transversely to the girders, and extending approximately 2½ ft. from the face of the girder; in these were placed steel rods near the upper surface, and the concrete replaced.

A diagrammatic representation of this method of making repairs is shown in the sketch. Had a small amount of reinforcement been placed just below the upper surface of the floors, and running transversely over the girders when the floors were laid, it is probable these cracks would never have appeared. It is not expected that there will be any further trouble.

A Steam Interurban Car.

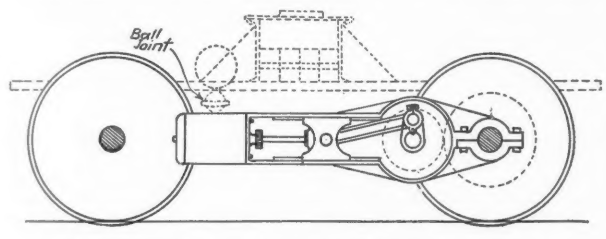
Mr. W. G. Wagenhals, General Manager of the Ohio River & Columbus Ry., has designed a steam interurban car which is now being built by the St. Louis Car Company. The car will be 60 ft. long over bumpers, standard width and will be capable of developing 320 h. p. It will be equipped with a boiler made by the Roberts Safety Water Tube Boiler Co., of Red Bank, N. J., which will be 6 ft. x 8 ft. x 6 ft. high, with 900 sq. ft. of heating surface, 30 sq. ft. of grate area and will weigh 11,000 lbs. This type of boiler, it is claimed, cannot be exploded and the only damage resulting from the rupture of a tube will be the extinguishing of the fire. These boilers are used by the United States Government, after being subjected to a Government inspection for 250 lbs. working pressure. Mr. Wagenhals' object in adopting this type is to avoid the danger of putting an ordinary high-pressure boiler in a car filled with passengers. The boiler takes up 15 ft of the front end of the car and a coal pocket is so placed that one man can run the car. A



Wagenhals' Steam Motor Car.

duplex horizontal engine drives the forward axle of each truck by means of spur gearing. For roads with grades not to exceed 2 per cent. the gearing is rigid; that is, no change in the ratio of the gears is provided for, this ratio being determined by the grade and load. The engine cylinders are 5 in. x 8 in. and take steam at 175 lbs. The crank case, guides, etc., are cast-steel, made in one piece, and all parts of the engine are protected with dust and oil proof cases. The engines have brass or bronze bearings and the splash system of lubrication is used.

The designer has a special shifting device by which instead of shifting the gears, he shifts the engines to utilize two ratios of gearing between them and the axles. The rough sketch herewith gives a general idea of the scheme. It is intended for use on heavy grades or for heavy loads, it being possible to double or treble the drawbar pull by its use. The gears are keyed to the axle and there are two corresponding pinions on the engine shaft. Outside of each bearing of the engine on the car axle is an air cylinder through which the axle revolves. The piston of each of these cylinders is capable of shifting the engine sidewise 5 in., bringing into combination the other set of gears. The cylinder end of the engine is supported by a ball-and-socket-joint, permitting movement in all directions. This joint is suspended from a cross-head which is connected to the piston rod of an air cylinder as shown. The engines are held in line by a latch or lock which ordinarily takes all strain off the piston rod. Upon release of the lock the engines may be moved to



Engine Suspension, Wagenhals' Steam Motor Car.

change gearing while the car is in motion, the gears being feathered on the shaft to permit this.

Mr. Wagenhals first designed and built the small inspection car illustrated herewith, from which the design of the larger car was developed. This car weighs 5,500 lbs. It has a duplex 3½-in. x 3½-in. slide-valve engine, geared direct to one axle. The driving wheels are 20 in. in diameter, and the car has demonstrated its ability to develop a speed of 18 to 20 m. h. p. up a 2½ per cent. grade 5 miles long. The vertical tubular boiler is 18 in. high and 24 in. in diameter. Mr. Wagenhals reports that he has repeatedly made a 24 mile trip on 2 bu. of ordinary bituminous coal at a cost of 14 cents. The car, if arranged for passengers, would be able to carry 20 persons.

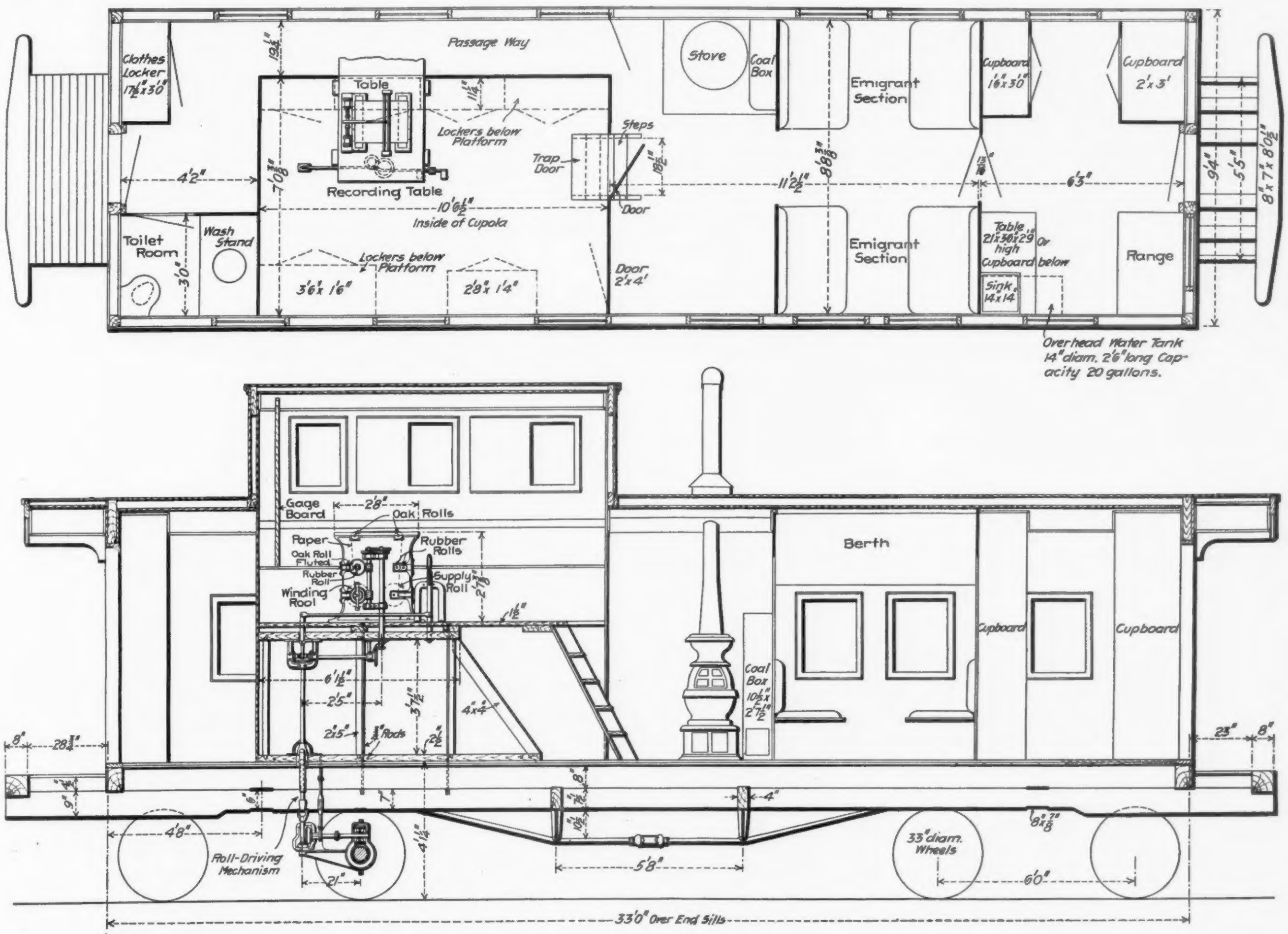
As compared with ordinary steam road service, Mr. Wagenhals figures that besides the economies of operation already mentioned, he saves the wages of two men at least, namely a fireman and brakeman. The Ohio River & Columbus is 24 miles long and the passenger business does not at present justify the operation of regular trains. There was no acceptable present substitute, however, which was the reason for the production of the design now being built.

Slatin Pasha, of the Egyptian general staff, throws cold water on Cape-to-Cairo Railroad project—that is, to the northern end of it. To build from Khartum to the Victoria Nyanza, he says, would be throwing away money, and if built it probably could not be worked during the rainy season. But the contemplated regulation of the Nile above Khartoum would open navigation a long way in that direction, though the work is intended primarily to increase the water supply lower down.

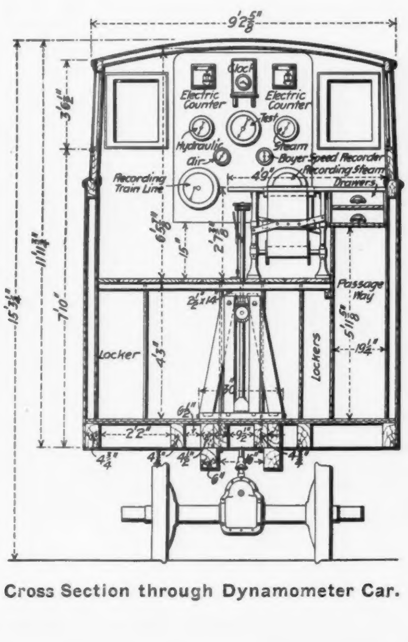
Northern Pacific Dynamometer Car.

The Northern Pacific completed in the latter part of 1904 a dynamometer car of the hydraulic type. It was patterned after the Burlington car, which employs the principle used by Prof. L. P. Breckenridge, of the University of Illinois. As both the University of Illinois car and the Burlington car have been described in detail (*Railroad Gazette*, June 20, 1900; June 7, 1901, and May 2, 1902), details of the mechanism of the car will not be reproduced or described here.

It will be remembered that the dynamometer consists of an oil cylinder, the piston of which is connected to a specially designed drawbar yoke. The drag of the train comes on the oil cushion in the cylinder and the pressure is transmitted by pipes to the recording apparatus in the car. This latter consists of two small cylinders in line, about 12 in. apart, with a common piston rod. The pressure on each small piston is opposed by a calibrated spring of known deflections under given loads. These springs move a lever arm which operates a pen carriage supported by and moving between guides.



Plan and Longitudinal Section through Northern Pacific Dynamometer Car Showing Arrangement of Apparatus.



Cross Section through Dynamometer Car.

The interior arrangement of the Northern Pacific car differs somewhat from the other cars, and drawings showing the arrangement are reproduced. A 33-ft. caboose car, remodeled and reinforced, was used. There is a toilet and lavatory room at one end and a kitchen with a small range at the other. Two standard tourist sections next to the kitchen furnish sleeping quarters. The operating table and recording mechanisms are given a much more elevated position in this car than in the similar cars already mentioned. A work bench, vise and set of tools is provided for, doing such light repair work as may be necessary. The car is heated by a standard caboose stove. Although the car has been in service since last fall, no elaborate tests have yet been made with it.

Program of the Master Car Builders' Convention.

The thirty-ninth annual convention of the Master Car Builders' Association will be held at Manhattan Beach, N. Y., June 19, 20 and 21. Headquarters of the convention will be at the Oriental Hotel. The following program has been arranged:

OPENING MEETING,
MONDAY, JUNE 19, 1905,
10:00 A.M. TO 1:30 P.M.

Prayer .... 10:00 A.M. to 10:05 A.M.
President's Address ...... 10:05 A.M. to 10:30 A.M.
Intermission .... 10:30 A.M. to 10:35 A.M.
To allow visitors to retire should they wish to do so, although all are invited to remain.
Reports of Secretary and Treasurer .... 10:35 A.M. to 10:45 A.M.
Assessment and announcement of annual dues; appointment of Committees on Correspondence, Resolutions, Nominations, Obituaries, etc. .... 10:45 A.M. to 10:55 A.M.
Election of Auditing Committee .... 10:55 A.M. to 11:00 A.M.
Unfinished Business ...... 11:00 A.M. to 11:05 A.M.
New Business .... 11:05 A.M. to 11:15 A.M.
Discussion of standing committee reports on:
Revision of Standards and Recommended Practice .... 11:15 A.M. to 11:30 A.M.
Triple Valve Tests...... 11:30 A.M. to 11:40 A.M.
Brake Shoe Tests....... 11:40 A.M. to 12:00 M.
Topical Discussions:
1. The best method of preventing or minimizing the damage to metal parts of the right of way from salt water drippings. To be opened by Mr. C. A. Schroyer, S. C. D., C. & N.-W. Ry... 12:00 M. to 12:30 P.M.
2. Riveting yokes: Is not the method commonly followed of securing yokes to couplers with rivets from 1/16 in. to ¼ in. smaller than holes, unmechanical and ineffective? Should we not ream the holes to a good alinement, use rivets to fill them and bead rivets from opposite sides to insure, at least, filling them on one side? Is there any sense in making heavier drawbars, followers and cheek plates if this system of riveting spring yokes is to continue? To be opened by Mr. Wm. McIntosh, S.M.P., C. R. R. of N. J. .... 12:30 P.M. to 1:00 P.M.
Discussion of committee report on:
Air Brake Hose.—To follow up tests suggested in the report to the 1904 convention, under both present and proposed specifications and to report results .... 1.00 P.M. to 1.30 P.M.
Adjournment.

MIDDLE SESSION.
TUESDAY, JUNE 20, 1905,
9.00 A.M. TO 1.30 P.M.

Discussion of standing committee reports on:
Tests of M. C. B. Couplers .... 9:00 A.M. to 9:30 A.M.
Revision of Rules for Loading Long Materials .... 9:30 A.M. to 10:00 A.M.
Rules of Interchange, including reports of Arbitration Committee and Committee on Passenger Car Rules. 10.00 A.M. to 11.00 A.M.
Discussion of committee report on:
Arch Bars.—To prepare a design of arch bar truck for 100,000 lb. capacity cars ...... 11.00 A.M. to 11.15 A.M.
Discussion of committee report on:
Safety Appliances.—(a) To confer with Interstate Commerce Commission in regard to standards of the Association. (b) To prepare and submit a design showing (1) ladder, (2) location of ladder, (3) location of handholds on roof .... 11.15 A.M. to 11.30 A.M.
Discussion of committee report on:
Tank Cars.—To continue investigations and report results of tests as outlined in report of committee in 1904 .... 11.30 A.M. to 11.45 A.M.
Discussion of committee report on:
Steam connections.—To submit detailed dimensions for steam hose couplings ..... 11.45 A.M. to 12.00 M.
Topical Discussions:
1. The establishment of a standard height from top of rail to center of drawbar for passenger equipment cars. To be opened by Mr. T. H. Curtis, S.M., L. & N. R. R.. 12.00 M. to 12.30 P.M.
2. Is it advisable to use malleable iron for wearing surfaces? To be opened by Mr. T. A. Fogue, M. S., Soo Line .... 12.30 P.M. to 1.00 P.M.
Discussion of committee report on:
Repairs of Steel Cars.—To design a more effective form of fastening the center sills when cut off near the bolster .... 1:00 P.M. to 1:15 P.M.
Discussion of committee report on:
Stenciling Cars.—To submit a design for stenciling cars .... 1:15 P.M. to 1:30 P.M.
Adjournment.

CLOSING SESSION.
WEDNESDAY, JUNE 21, 1905.
9.30 A.M. TO 1.30 P.M.

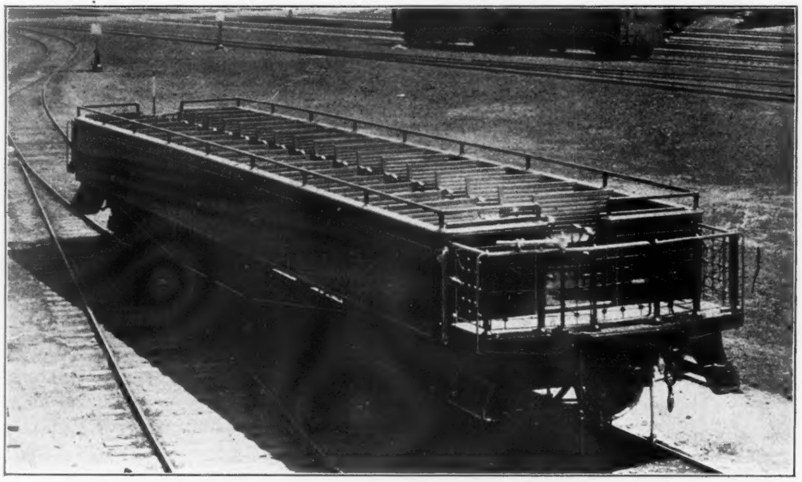
Discussion of committee report on:
Coupling Chains.—(a) To revise the present design for permanent safety chains for wooden cars. (b) To submit a design of chain for chaining cars together when hauling twin and triple shipments ... 9:30 A.M. to 10:00 A.M.
Discussion of standing committee report on:
Draft Gear .... 10.00 A.M. to 10.45 A.M.
Discussion of committee report on:
Cast-iron Wheels. — To consider the question of guarantee for wheels as proposed by the wheel makers and to submit same to the convention with its recommendations .... 10:45 A.M. to 11:15 A.M.
Discussion of committee report on:
Doors.—(a) To revise the outside sliding door, shown on M. C. B. Sheet F, and recommend a design for a flush door. (b) To consider the question of a suitable grain door to meet the requirements of the present large capacity cars .... 11.15 A.M. to 11.30 A.M.
Discussion of standing committee report on:
Subjects .... 11:30 A.M. to 11:35 A.M.
Unfinished Business:
Reports of Committees on Resolutions, Correspondence, etc. ..... 11.35 A.M. to 12.00 M.
Topical Discussions:
1. How does the M. C. B. cast-iron car wheel show up in service as regards the breakages of flanges? To be opened by Mr. R. L. Ettinger, C.M.E., Southern Ry. ...... 12:00 M. to 12:40 P.M.
2. Do we need greater braking power on freight cars? To be opened by Mr. F. M. Gilbert, N. Y. C. & H. R. R. R. .... 12.40 P.M. to 1.00 P.M.
Election of officers........ 1:00 P.M. to 1:30 P.M.
Adjournment.

New Speed Record.

The Pennsylvania westbound 18-hour train on June 12 covered three miles near Ada, Ohio, in 85 seconds, which is at the rate of one mile in 28⅓ seconds, and much faster than any previous record. On the Berlin-Zossen military road, the highest speed reported is 117.32 miles an hour, as a maximum recorded on a trial run of the electric car over a specially prepared piece of track 14.5 miles long. On the eastbound run of the corresponding Pennsylvania train, the same day, four consecutive miles, according to well authenticated accounts, were made in 38 sec., 37 sec., 37 sec., and 38 sec. respectively. The eastbound train was two minutes ahead at Altoona and three minutes ahead of time at Jersey City. Further particulars of these runs, including weight of train, etc., will be printed in a subsequent issue.

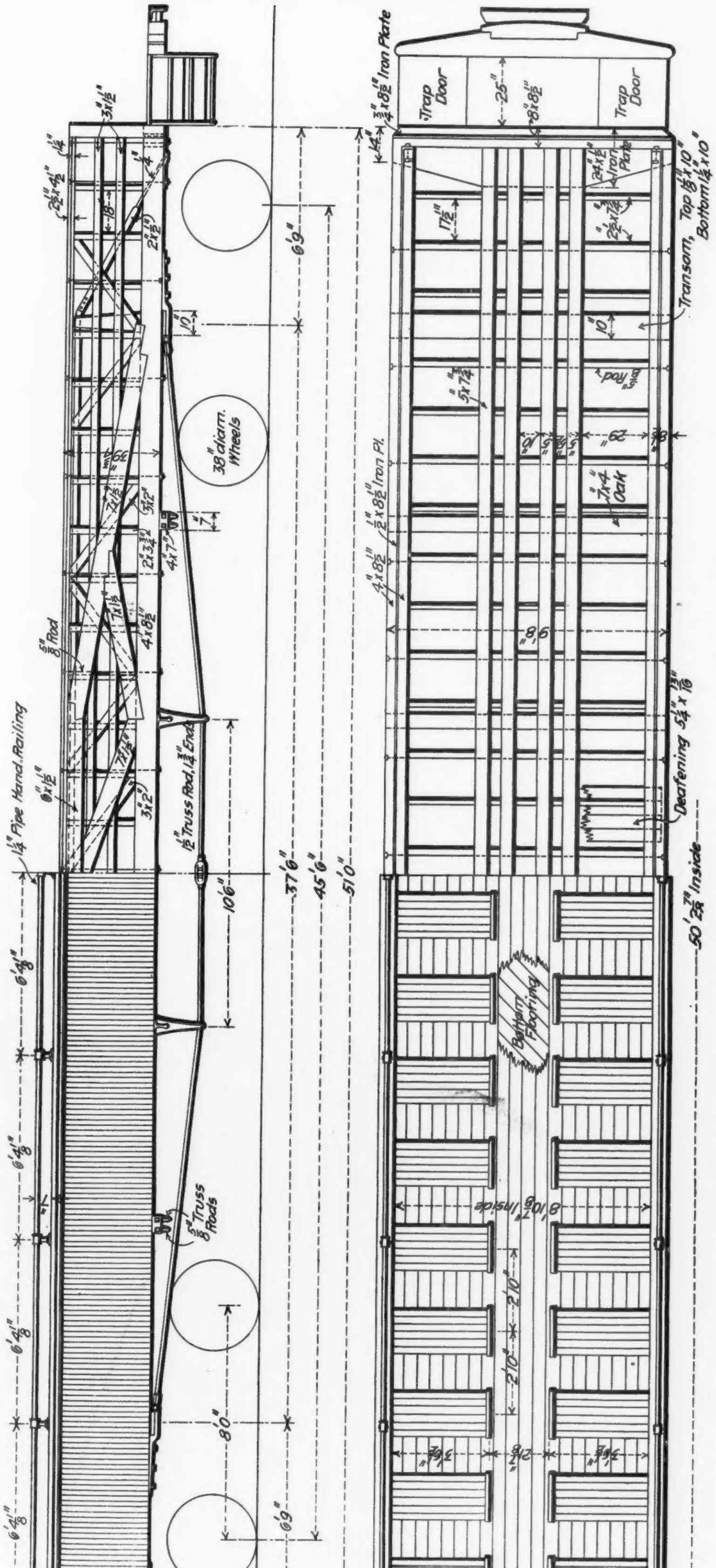
Open-Top Observation Cars of the D. & R. G.

The Denver & Rio Grande has introduced a new feature into its passenger equipment in the form of open-top observation cars for service on certain of its daylight trains during the summer months. There are three of these cars and they are attached to trains running through the Royal Gorge between Canon City and Parkdale; through the canon of the Grand river between Glenwood Springs and Gypsum; and through the Black Canon of the Gunnison between Montrose and Cimmarron. The design of the cars is such that a free and unobstructed view of the grand scenery of the Rocky Mountains may be obtained.



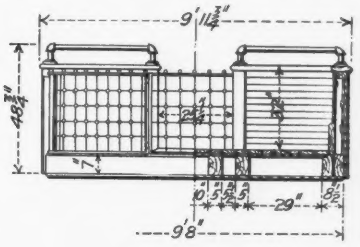
Open Observation Car—Denver & Rio Grande.

The cars, which have a seating capacity for 72 persons, are 51 ft. long and 9 ft. 8 in. wide. The construction is practically the



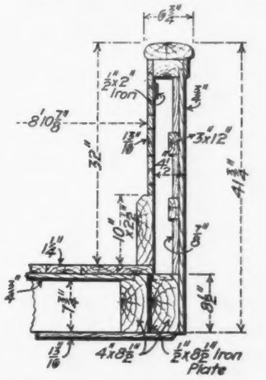
Plan and Side Elevation of Open Observation Car for the Denver & Rio Grande.

same as a regular passenger car up to the windows. It will be noted, however, that the outer intermediate sill is omitted and instead there is a double side sill formed of two 4-in. x 8½-in. timbers with a ½-in. wrought-iron sandwich plate between. The



End Elevation.

underframing is tied transversely at short intervals with ⅝-in. rods and the side framing is tied vertically in the same manner. Wooden slat seats, capable of holding two persons, are placed transversely. The interior finish is poplar painted Pullman standard color. The sides are surmounted with a hand railing made of 1¼-in. pipe, with



Section through Side.

brass trimmings. Both ends have observation platforms enclosed with brass railings. The cars are mounted on four-wheel trucks having Paige 38-in. steel-tired wheels. They were built at the Burnham shops of the Denver & Rio Grande.

Steel Car for the East Boston Tunnel.

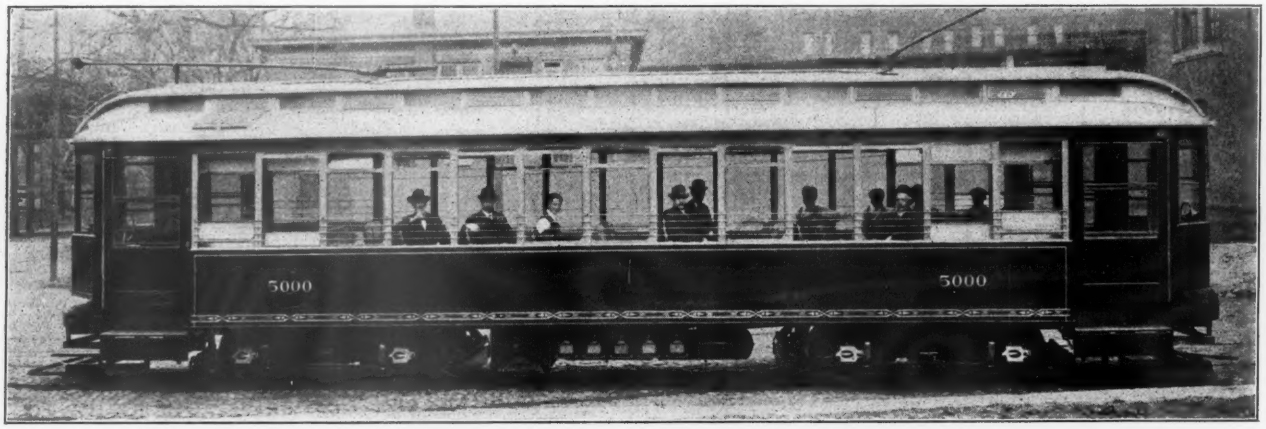
The Boston Elevated has recently built at its Bartlett street shops a street car of novel design and construction which is intended for use in the East Boston tunnel and the streets connecting therewith. The car is of a semi-convertible type so that it may be used in either summer or winter service, and is intended to provide a maximum carrying capacity, with quick and easy ingress and egress of passengers and having its entrances closed while in motion, with a view to the prevention of accidents. The car has no platforms, the floor of the car being continuous and at the same level to its extreme ends, and the car is closed by sliding doors in the side, with no full bulkhead separation between the platform portion and the body of the car. Attention has been paid to securing the greatest possible width of aisle, and, in construction, to attain the lightest possible weight consistent with necessary strength.

The general dimensions of the car are as follows:

Length of body	33 ft. 3 in.
Length over all	45 ft. 10¼ "
Width over all	8 ft. 6 "
Height from bottom of sill to top of roof	9 ft. 8 "
Height from rail to top of roof	12 ft. 3½ "

As the car was to be used in the tunnel,

it was desired to make it fireproof, or as nearly so as possible. The bottom framing is composed of steel angles and I-beams. The side sills are made of three angles hot riveted together in such form as to allow the window sashes to drop into the pocket to the bottom of and outside of the sill. The cross sills consist of I-beams riveted to the side sills with steel knees, and having oak fillers on either side. The end sills are made up of two steel plates 6 in. x 1 in. and 6 in. x ¾ in. formed to practically the same lines as the bolster, in an inverted position.



Steel Car for the East Boston Tunnel Service.

The extension of car beyond the main end sills, is supported by two pairs of 3-in. I-beams, with oak fillers, running under the top member, and resting on a casting on the bottom member of end sills. They extend back to the bolster and are secured to it. The outside supports are steel angles 6 in. x 3½ in., riveted to the side sills and securely bolted to the end sills. The ends are further supported by a ⅞-in. truss rod passing over the end sill and running back to the bolster. The slack in this rod may be taken up at the anchor casting on the outer end.

The floor is of hard wood painted with fireproof paint. On the under side it is lined with asbestos and further protected with heavy sheet tin thoroughly painted on both sides.

The body framing consists of 12 T-iron posts on each side, running straight up from sill to roof plate and interlocked at the window stool. The letter board is a 7-in. x. ¼-in. steel plate running the entire length of car and riveted to the posts. The sides of the car, from sill to windows, are built in with longitudinal sheathing ¾ in. thick, and covered with ⅛-in. steel plates riveted to the window stool and bolted to the side posts. The roof has a clere story covered with 8-oz. duck, painted and sanded.

Other interesting features of the design are the side doors at the ends and the folding step operated by compressed air. The doors are 3 ft. 6 in. wide and will admit two persons side by side directly into the car, the platform being really a part of the car body. The motorman's cab is so arranged with folding doors as to make a separate compartment while in use. These may be folded out of the way, leaving the space open. A pocket, lined with sheet iron and asbestos, is provided in the cab over the motorman's head, and contains all switches, fuses, etc., mounted on slate panels.

The maximum inside width of car is obtained, the wall being only 2½ in. thick, thus with an 8-ft. 6-in. over all dimension there is an inside width of 8 ft. 1 in., which admits of cross seats 34½ in. long and a 28-in. aisle.

The sashes are of channel bronze and are divided into two parts, the top sash being 9 in. x 28 in. It may be raised its full height. The lower sash is 33 in. x 28 in. and it may be lowered flush with the top of window stool, which is but 27½ in. from the floor. This is accomplished by the novel side sill construction which, with the car siding, forms a pocket into which the sash is dropped.

The window pockets are provided with an automatic cover which comes into place and prevents the dropping of articles into the sash pocket when the sashes are raised.

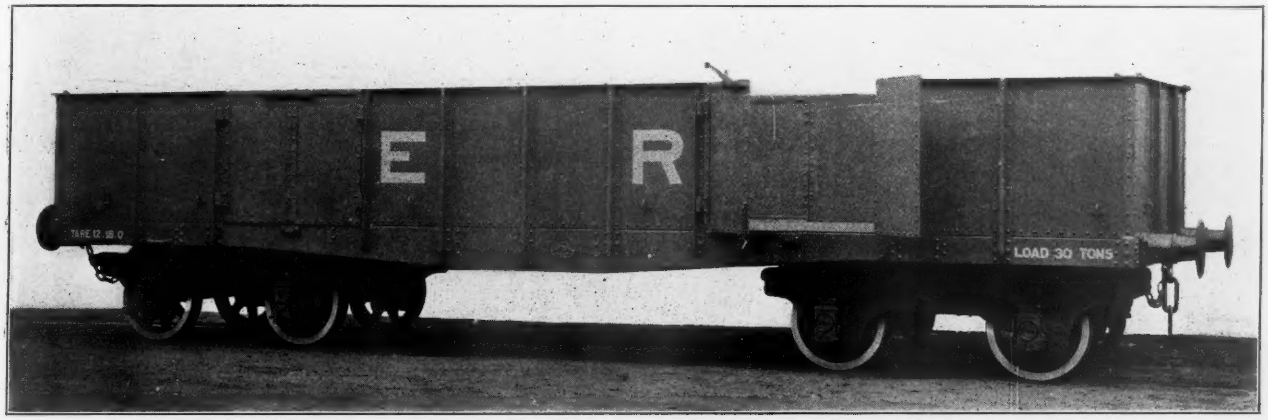
There are 14 reversible transverse, four fixed transverse, and four longitudinal seats, giving a seating capacity of 52 persons with ample knee room, and a floor space of 12 ft. from the end of the car to the first cross seat. The interior of the car is lined with sheet aluminum, the headlining being finished in its natural color and the standing finish painted a rich olive shade, decorated in gold. The car is illuminated with six five-light circuits and provided with illuminated signs.

Interior of East Boston Tunnel Car.

The electrical equipment consists of four GE-74 motors having a rated capacity of 65 h.p. each, and Sprague General Electric Control similar to that installed on the new elevated car equipment of the company. The 15 contactors, with interlocks and auxiliary rheostat, are arranged in one iron box beneath the car, the cover of which is arranged conveniently for inspection and adjustment of contactors and interlocks. The reverser, which is also beneath the car, is well protected by an iron box which also contains switches for cutting out the several motors; all wiring is run in iron pipe conduits, and great care has been taken to eliminate all possibility of fire. One important feature of the control equipment is the automatic relay throttle which governs the acceleration of car; another is the train line cut-out switch by means of which the motorman can open the train line circuits on each car. It is intended to use this car as a motor car of a train of two cars of like size, the train to be driven either end forward, the second car being without motors. The tunnel contains long grades of 5 per cent. and less, and at present affords no opportunity for looping cars at the terminal. The motors are mounted on Brill's 27-E-1 trucks having 33-in. steel tired wheels and 4½-in. axles.

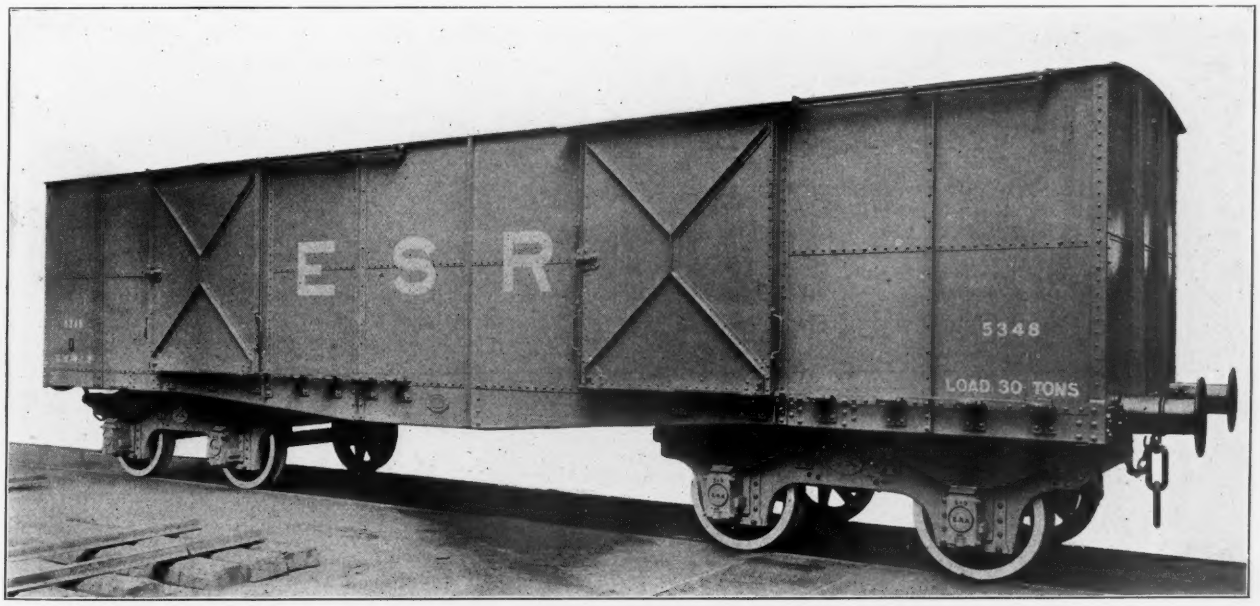
High-Capacity Steel Cars for the Egyptian State Railways.

The accompanying illustrations show two new types of high capacity steel cars, a number of which have recently been built for the Egyptian State Railways by the Leeds Forge Company. The first is a 30-ton gondola, 34 ft. long, 8 ft. 9 in. wide, and 4 ft. deep, inside measurements. It has a cubic capacity of 1,185 cu. ft. and a light weight of 28,900 lbs. These cars will be used in coal traffic and have two doors in each side to facilitate unloading.



30-Ton Steel Gondola for the Egyptian State Railways.

The second type of car is a covered car also of 30-tons capacity and built entirely of steel. These cars are intended primarily for carrying grain in Lower Egypt, and are 34 ft. long, 8 ft. 9 in. wide, and 6 ft. 5 in. high, inside. The sides and roof are made of steel plates stiffened with light angles and the underframe is pressed steel with fish-belly sills. There are two door openings in each side 4 ft. 9½ in. wide, closed with sliding steel doors made of a single plate reinforced on the outside with diagonal angle stiffeners. The cars have a cubic capacity of 1,900 cu. ft. and a light weight of 31,500 lbs. Both types of cars are mounted on Fox pressed steel trucks with outside elliptic springs. The trucks are for a 4-ft. 8-in. gage, and have a wheel base of 5 ft. 6 in. On account of the extreme dustiness in Egypt the center plates and side bearings have been made with extra large surfaces to prevent undue wear from cutting. The wheels are 33 in. in diameter with spoke centers and steel tires.



Steel Box Car of 30-tons Capacity for Egyptian State Railways.

New Chicago Headquarters for the Postal Telegraph.

The Postal Telegraph-Cable Company has recently moved the headquarters of its entire western division from its former offices in the Chicago Stock Exchange building into the Rialto building, which has been enlarged and remodeled and named the Postal Telegraph building. The main operating room is 170 ft. long by 67 ft. wide and 24 ft. high, and seats 472 operators. The switchboard is composed of 11 sections, each of which accommodates 50 wires, making a total of 550 main line wires. All messages are handled direct from the wire on typewriters, no pencils or ink being used in the office, and the lighting of the room has been especially considered with a view to avoiding shadows on the typewriter keys.

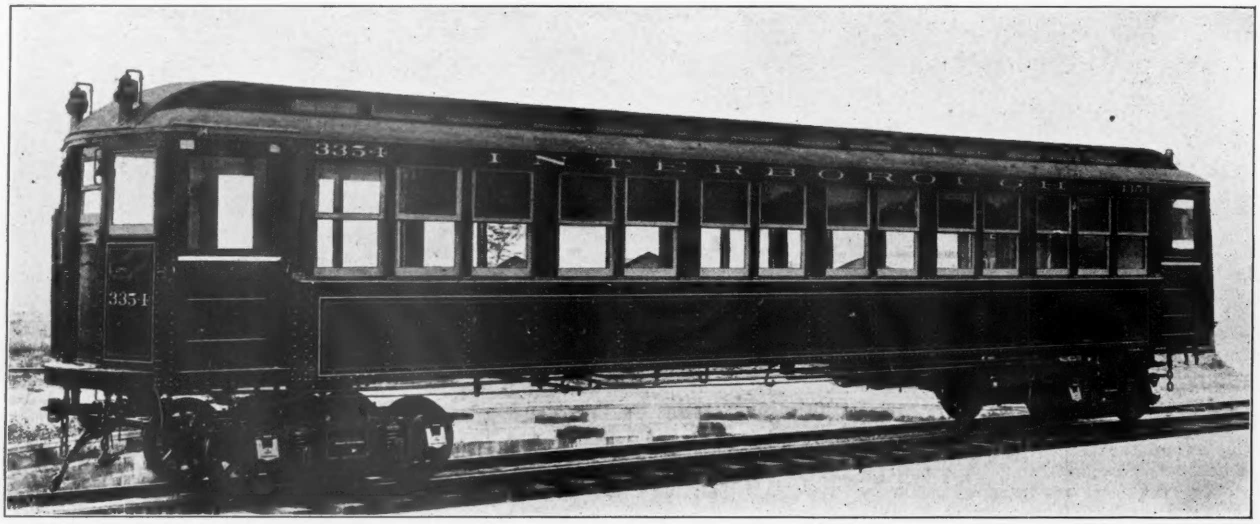
Fifty duplexes and 60 quadruplexes are provided to take care of the through traffic and the leased wires of the company, while 100 single Morse sets are allotted to the traffic on way and city wires. There are 15 sets of single wire repeaters, 10 sets of direct point duplex repeaters, used on through wires, and every table is connected up independently and so arranged that it can be worked in any and every combination that the Division Chief in charge desires.

The basement terminal pin-jack arrangement is the first of its kind ever installed. It facilitates the testing of cables, to locate trouble, and by a system of cords any one cable can be cross-connected without a moment's delay, bringing the wires to the switchboard in their regular place. In addition to the basement terminal, there is a cross-connecting frame immediately behind the switchboard, with a capacity of 7,000 wires, and in the gallery over the switchboard is another cross-connecting frame of similar capacity, the switchboard being connected to both cross-connecting frames with 25-conductor and 50-conductor cables, and it is possible, with this improved system of transfer, and the connecting frame, to change the location of sets, loops or wires, without breaking a single connection. The operating plant consists of 25 motor generators arranged for day and night service. The Chicago Edison Company furnishes the power and also provides an emergency lead, but the Postal Company has also installed engines and dynamos of sufficient

capacity to take care of its service in the event of interruption of the Edison service.

The moving of this vast plant from the Stock Exchange building to the new Postal Telegraph building was effected without the least interruption to business, and was accomplished without any breaking of the circuits. Indeed, the fact that the office was being moved was unknown to any outside office having wire connection with Chicago. It was begun at 3 o'clock Easter morning, and completed by 7 a.m., and Monday morning the hundreds of operators, clerks and messengers took their respective places in the new building and business was handled without hitch or delay, in spite of the fact that that day, on account of the May wheat excitement on the Board of Trade, and the financial difficulties of the Milwaukee bank, brought the company the largest business of any Monday in its history.

The work of arrangement, wiring and fitting up of the offices, was begun nearly a year ago, under the supervision of E. J. Nally, General Superintendent; T. W. Carroll, Electrical Engineer; C. L. Bennett, his assistant in charge, and F. W. Conger, Superintendent, and a staff of expert engineers and electricians. Mr. Carroll had full charge of the wiring arrangement of the operating room, terminal rooms, power plant, cable and pneumatic tube systems, and to him is due the credit for the highly satisfactory manner in which the equipment was installed, and the successful way in which the gigantic task of the removal was accomplished.



Steel Car for the Interborough Rapid Transit Subway, New York.

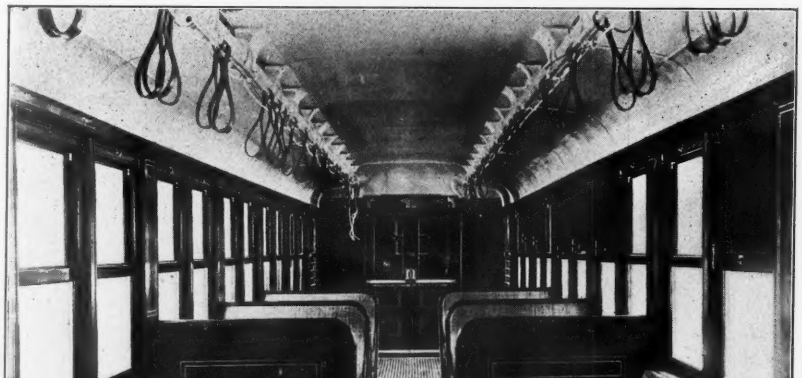
Some New Steel Passenger Cars.

The use of steel in passenger car construction is an innovation of the last two years, but in that time a number of designs have been prepared and there are now in service enough cars built entirely of steel to satisfactorily demonstrate their superiority in strength, running qualities and immunity from fire. Among the first steel cars put in actual use in this country were those designed by Mr. George Gibbs and built at the Berwick, Pa., works of the American Car & Foundry Co. for the Interborough Rapid Transit Subway in New York. These cars were quite fully illustrated and described in the *Railroad Gazette*, Sept. 30, 1904. A large number have been in service in the Subway since it was opened last October, and on two occasions have conclusively proven their fire-resisting and collision-proof qualities. One of these was in a collision which occurred during the strike of Interborough employees last March in which a wooden car, between the third and last steel cars in a train standing at a station was badly damaged when the standing train was struck by a following train, while neither of the steel cars which received the actual shock of the collision was badly damaged. The other occasion was the fire in the uncompleted tunnel at 165th street on the Broadway division last April, in which a train composed of both steel and wooden cars was subjected to intense heat for some hours. The wooden cars were entirely consumed but the steel cars were intact, although the fire was hot enough to melt the aluminum head linings and interior finish.

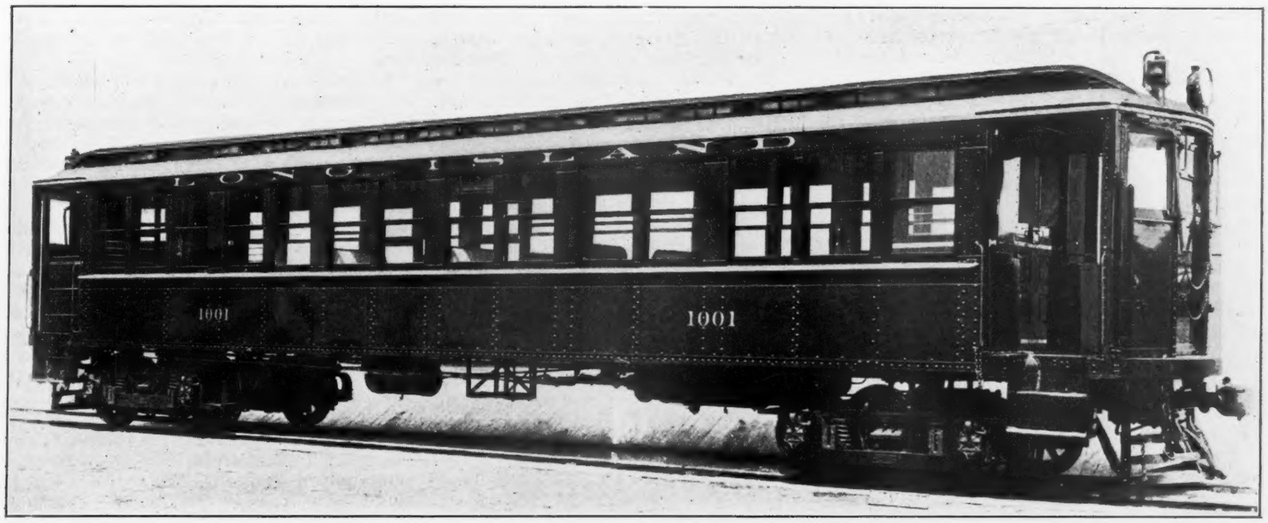
It was thought when the steel cars were first proposed that it would be difficult to reduce the noise resulting from the use of metallic parts, but experience with these cars in the Subway where excessive noise is particularly objectionable, has shown that they ride as quietly as the wooden cars. The design of car used in the Subway having proved so successful, it has been adopted with a few minor changes for the suburban trains on the electrified lines of the Long Island Railroad, which will be opened for traffic this summer. The principal dimensions of the Long Island cars which have also been built by the American Car & Foundry Company at Berwick are as follows:

Length over body corner posts	41 ft. 0½ in.
Length over buffers	51 " 2 "
Width over sheathing	8 " 7 "
" " eaves of upper deck	5 " 7¼ "
" " eaves of lower deck	8 " 8 "
" " window sills	9 " ½ "
Height, under side of sill to top of plate	7 " 1 "
" body from under side of center sill to top of roof	8 " 9¼ "
" from top of rail to under side of sill at truck center	3 " 3⅝ "
" from top of rail to top of roof	12 " ¾ "
Weight of car body complete with brake	38,500 lbs.

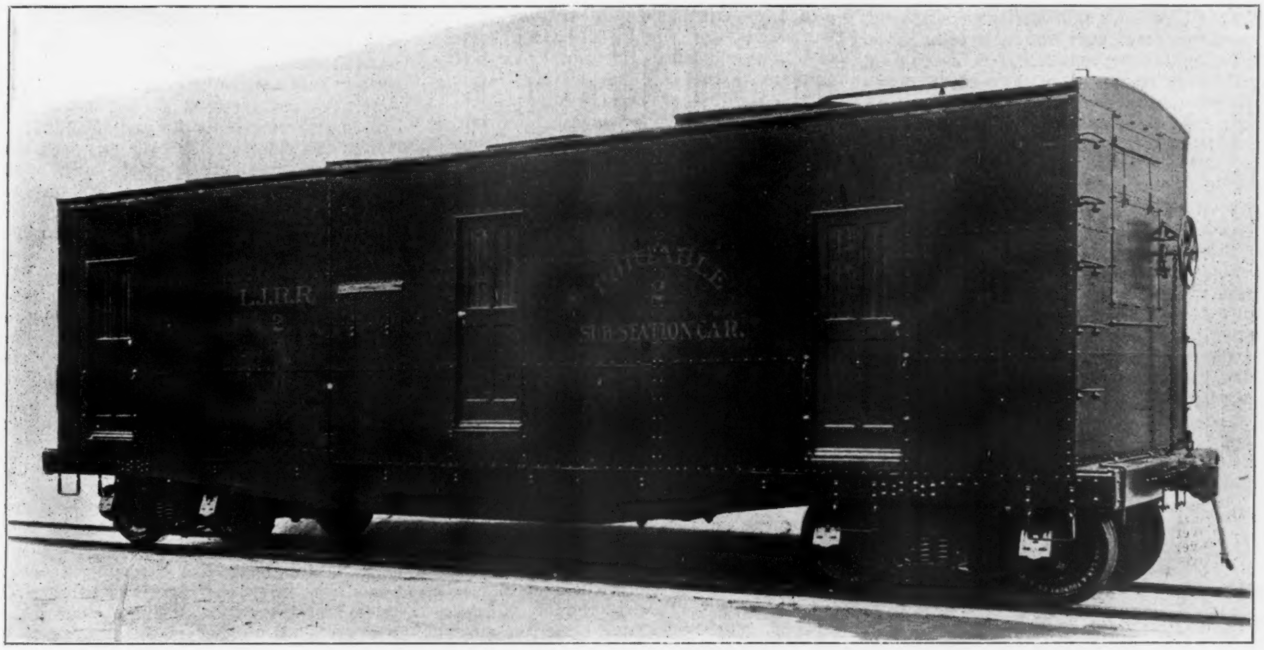
The interior arrangement of the car has not been modified. There are eight cross seats in the center and longitudinal seats along each side, giving a total seating capacity of 52 persons. As the station platforms on the Long Island will not be raised to the height of the car floor it was necessary to provide steps. The side platform sill has been omitted and the floor is cut out far enough back to admit of dropping two steps without encroaching on the clearance limits of width. The steps are about three-quarters of the width of the platform, and when the car is running the opening in the floor is covered with a steel plate extend-



Interior of Interborough Steel Car.



Steel Motor Car for Suburban Service—Long Island Railroad.



Steel Car for Portable Sub-Stations—Long Island Railroad.

Steel Motor Car for the London Underground Railroad.

ing out under the sliding side door. When the door is pushed back the floor plate can be raised. The only other changes are in the application of a skeleton fender at each end of the car, M. C. B. couplers instead of the Van Dorn radial drawbar, and a headlight on the roof between the signal lights.

Another interesting car built by the same company for the Long Island is shown in one of the illustrations. It is a portable sub-station car intended to have mounted in it a complete sub-station outfit consisting of transformer, rotary converter, switchboard, etc. Several of these cars will be used in the electrified zone to assist the permanent sub-stations during extreme load periods. The cars will be distributed on sidings and the electrical apparatus connected to the high-tension feed wires and the third-rail circuit. They are built entirely of steel to guard against fire and are made heavy and strong to support the heavy machinery which they carry.

Perhaps the most interesting of recent steel passenger cars are those built by the American Car & Foundry Company for the Baker Street & Waterloo Underground in London. This road is one of the latest "tube" railways to be opened in London, and as in the New York Subway, the use of steel cars was an important safeguard against accidents by fire or collision. On account of the limited clearances in the tunnel it was a difficult matter to design a car having sufficient head-room and at the same time put under it motor trucks of large enough capacity. The American Car & Foundry Company after submitting designs some time ago received an order for 36 motor cars and 72 trailers. These cars were built at the Berwick works and shipped "knocked down" to Manchester, England. The builders bought ground in Trafford Park, a manufacturing district near Manchester, and put up temporary shops for erecting the cars before delivery to the railroad.

The illustration shows one of the motor cars which has the following dimensions:

Seating capacity		46
Length over car body	42 ft.	9⅜ in.
" inside passenger compartment	34 "	9¼ "
" inside motor room	7 "	7 "
" over buffers	50 "	0¼ "
" over end sills	49 "	1½ "
Width inside	8 "	1¼ "
" over side sills	8 "	0 "
" over belt rail	8 "	9¼ "
" over all	8 "	10¾ "
" at eaves	8 "	2 "
Height from rail to top of floor	0 "	22 "
" from rail to top of floor in motor room	3 "	6⅛ "
" from rail to top of roof	9 "	5½ "
Truck centers	33 "	0 "
Diameter of wheels: 30-in. on trailer truck; 36-in. on motor truck.		
Weight of body		28,000 lbs.
Weight of trucks, without motors		17,350 "
Total weight, exclusive of elec. equip.		45,350 "

The car has a motor truck at one end only and in the compartment at that end is mounted all the electrical apparatus, thus concentrating a heavy weight over the adhesion wheels. The motorman occupies the compartment formed by the enclosed platform which has side doors and end windows as well as a double end door in the center. The motor compartment is separated from the passenger compartment by a steel bulkhead which prevents any danger to the passengers in case of a short circuit. At the opposite end of the car the entrance platform is not roofed over but the deck roof is extended out to cover the central gangway.

The motor trucks have cast-steel side frames with double pedestal springs and elliptic bolster springs. On account of the low floor a special form of truck with side frames suspended from the axle boxes has been used for the trailer trucks.

The trail cars have the same cross-section as the motor cars and are approximately the same length over buffers. They are entered from both ends, however, and the floor is the same level throughout. They are mounted on trucks similar to those used at the rear end of the motor car. Four-car trains will be run, made up of a motor car at each end with two trailers in the center. The following table gives the general dimensions of the trailer cars:

Seating capacity		52
Length over car body	41 ft.	11¾ in.
" inside	41 "	2½ "
" over buffers	50 "	2 "
" over end sills	49 "	1½ "
Width inside	8 "	1¼ "
" over side sills	8 "	0 "
" over belt rail	8 "	9¼ "
" over all	8 "	10¾ "
" at eaves	8 "	2 "
Height from rail to top of floor	0 "	22 "
" from rail to top of roof	9 "	5½ "
Truck centers	33 "	0 "
Diameter of wheels		30 "
Weight of body		25,000 lbs.
Weight of trucks		13,000 "
Total weight		38,000 "

We are indebted to Mr. John McE. Ames, Mechanical Engineer of the American Car & Foundry Company, for the illustrations and information.

The Technical Education of Railroad Employees.*

As a superintendent of motive power a generation ago, a good mechanic sufficed. He was an old locomotive runner, or a shop foreman promoted, and he was usually called "master mechanic." It was but a short and comparatively easy step from the locomotive, or the shop, to the position of head of the department. In the present day of record-making, of heavy locomotives, large-capacity cars, strenuous operation, large shops and intricate labor problems, such a step is now a hopelessly long one.

The sort of man who successfully directed the department 25 years ago would find his ability overtaxed to properly manage a single busy roundhouse to-day. A different kind of ability is now required to direct the mechanical department of a single progressive road, and as great roads combine into systems still another new kind of a man will be needed. He must soon be ready, for his work is even now waiting. Is this appreciated? Are the men being prepared?

Other departments have their problems, but where are the chief officers required to have as many different difficult qualifications as in the motive power department? Who must be as many kinds of a successful man as a superintendent of motive power? Where else must a man be an engineer, a business man, an organizer, an executive, a manufacturer and a diplomat? Where else are men required to know as much as these officers must know? What other railroad officer is there who must compete against conditions of labor and management with the best industrial establishments? Who else on the road has anything like the locomotive, or like shop piece work to deal with? But these are merely items among the cares of these men. Is any one doing anything systematically and seriously to permanently improve the labor situation? This is but another part of the problem given them to solve.

It is no small task to properly direct the design, to operate and maintain a thousand or more traveling power stations, such as modern locomotives have become, and to build up a policy and an organization sufficient for such an undertaking on a single road, let alone doing this for a combination of roads. No other class of men in the world—without exception—is ever called upon to do what is everywhere expected of motive power officers, and the demands increase continually. The problem has grown perceptibly in two years and enormously in five.

The problem is the selection, preparation and training of men. If this is provided for the rest is easy. It is said to be less difficult to secure a new president than to secure a good shop or roundhouse foreman. This is, of course, not true, but it certainly is sufficiently difficult to obtain the necessary supply of foremen of the right sort and even more difficult to secure the right kind of men in the ranks. The men are not essentially different from those of a generation ago, but the conditions certainly are different. To improve conditions it is necessary to know what is wrong, and to know what is wrong it is necessary to understand the changes which the last few years have brought.

A few years ago railroad mileage was computed in hundreds, whereas now it is measured in tens of thousands. The general manager once knew all of his subordinate officials, because they were few and changes were not frequent. He once knew all of his master mechanics, station agents, conductors, engineers, despatchers and even telegraph operators. They knew him and were working for him because he was personally close to them in their work. All this has changed as the roads themselves became greater and as roads great in themselves combined into systems, as has never been done anywhere else in the world. With this change the officers have by a powerful current been carried far from the men in the ranks and far even from their subordinate officials. From personal friends, the men have become to them as mere numbers.

For example, we have one motive power officer who is responsible for the service of more than 40,000 men. How many of them can he know? He does well to really know his chiefs of staff. From a simple business proposition, administration of railroads has become like the direction of the armies of a nation. But armies do not suffer weakness of organization because of increasing in size. An army becomes larger by aggregation of units, which of themselves become no larger. As size increases general officers are added. The commanding officer does not know all his men, but the captains do know theirs. From this standpoint the railroads need more captains, because the subordinate officers now know their men as little as the chiefs know their subordinate officers.

The recruiting and training is the same for a large as for a small army, because the units are of the same size. It is not so with railroads. For example, consider the organization of a new and large locomotive shop compared with a small one. This is one reason why the large shops of to-day are less efficient and less economical than the small ones. Shops have outgrown both men and methods.

The recruiting of shop forces in the past was through apprenticeship. It is not so to-day. One of the best equipped railroad boiler shops in the country has not a single apprentice and few of them have enough to be worth mentioning. Of twelve trades in one shop plant only three were found to have apprentices, but all had shop committees. In other departments apprenticeship has been overlooked and neglected because there was so much else to do. There has been too much pressure to turn out work with existing facilities to admit of taking the necessary precautions concerning the men and the leaders of the future. The present demand for foremen with leadership talent and executive possibilities proves both the neglect of the apprentice and the distance which has grown between the officers and the men, for there certainly must

*Extracts from a paper by Mr. George M. Basford, Editor of the *American Engineer and Railroad Journal*, read before the American Railway Master Mechanics' Association, June 15, 1905.

be latent talent, dormant and undiscovered, sufficient for all necessities.

We need to be reminded that many men in the ranks are sure to rise in one way or another. If they are not encouraged in every possible way to qualify for higher positions on the staff they will employ their leadership in other directions, and here is an opportunity to reach one of the roots of the labor problem which has already been allowed to wait too long.

The writer recently discussed this subject with a railroad officer who, with a gesture toward his shop, said: "I have here 2,500 men and not one of them can I promote to take charge of a roundhouse which is badly in need of a foreman." It cannot be true that of that number not one was worthy and prepared for advancement, but that officer believed it to be so, which is nearly as bad. Another well-known superintendent of motive power says: "I have more trouble in getting proper pay for foremen than to find good men to act in that capacity. If a job is worth $150 per month I find difficulty in getting a $150-man to take it at $90 per month." This is another vital matter. Because railroads are neglecting organization methods, it is the exception rather than the rule, to promote mechanical officers to fill vacancies. It is not safe to continue this. The officers must be encouraged by promotion and they must be required to know their subordinates in order to promote them. Under the old apprentice system ability was quickly discovered, and in proof of this the best high officers of the time have come through apprenticeship, and most of them rose rapidly.

To-day telegraph operators, firemen, trainmen and others are usually taken from outside the service. They receive less preparation for their work than when there was less responsibility and less to do. The recruiting system is at fault, this being considered as unimportant. It is not so in England and in Europe, where the efficiency of the individual railroad employee is of the highest type.

Apprenticeship of the old kind was an ideal method of recruiting. Boys were carefully selected, conscientiously trained, and the employer exercised a moral as well as an educational influence over them. The present pace does not permit of such a system, yet the lack of it has brought a deplorable condition, and to take its place something is needed and that quickly.

For 20 years the railroads have sought to provide the necessary leadership from the technical colleges and many strong officers have developed through what is known as the special apprentice system. It is perhaps possible to meet the immediate need in some such way; but when the technical school graduates come to the railroads, as outsiders, from the schools—as they usually do—this system is doing a fundamental injury, which is neither understood nor appreciated, but it is nevertheless serious. Every time a special apprentice is started on his course notice is, in effect, served upon the men and boys with whom he works, that he, because of his education, is to acquire in a few years sufficient knowledge, experience and ability to become one of the official staff. The effect in the shop is to discourage those who have not had such education. The special training of young men from without the ranks of the workers, for official positions, is fundamentally wrong, and, furthermore, it plays strongly into the hands of those who wish to see men leveled into classes, and considered as on uniform levels, as to the value of service. It may be necessary to continue special apprenticeship for a time. Technically educated men are needed and will be needed even more in the future, but they should come from the ranks and not from outside of the service. The present system, or any other system, which in any way serves to discourage the regular apprentices and thereby tends to cut off the source from which most of the successful men have come should give place to a system which will encourage all by making it possible for the lowest to become the highest in the briefest possible time, because the talent is needed now. Nothing adequately meeting the needs of American railroads has been accomplished either here or abroad. That such a system is possible and feasible can now be shown.

The suggestion is that recruits in shops (and this applies in principle, though not in detail, to other service) should be taken in as apprentices. They should be given shop training, which will increase their earning capacity to the utmost, and they should be placed under the direction of men of such character and moral influence as to lead them to form correct, broad and honest views of life and their proper relations with other men and their employers. Parallel with the shop training, attendance during working hours at a school provided and maintained by the road should be required; and for this a new kind of a school must be developed, as a new kind of apprenticeship must be developed—the kind that will meet the individual cases. They must not be dealt with in classes or by fixed rules. The school must be one wherein the shop and the studies go hand in hand. While the shop hours are taken for the school, home work should be rigidly required. Life must not be made too easy for the apprentices.

For example: Arithmetic is needed of the kind which will deal with pulleys, back gears, lead screws and other studies such as drafting and shop arithmetic, which will reveal the reasons for things seen and done in the shops. The school and the shop should be co-ordinate in every possible way. The local officers must be interested in and responsible for the boys in the school as well as in the shop. The higher department officers must be occasionally seen in the school room and the foremen should be identified with it. An evening a month should be devoted to a general meeting of an apprentice organization, with an occasional stereopticon talk or lecture by a foreman or higher official. Here is an opportunity for the university extension idea. The boys should visit other shops in committees and report their observations for discussions. A library for books and periodicals is a necessary element. If the road has several shops a car should be equipped with valve motion models, sectioned locomotive apparatus and appliances, electric motors and generators and even a small stationary engine for the boys to study, dismantle, assemble and set the valves. The airbrake cars have shown us how to use school cars.

As a part of the plan, every roundhouse should have a comfortable reading-room, provided by the company, with books, periodicals, charts and models. Every encouragement should be given the engineers and firemen to organize improvement clubs. The company should furnish stereopticons and occasional lecturers. Progressive education should accompany the present tendency toward progressive examinations. Here is another opportunity for university extension. Engineers and firemen should be educated to do their best, and it is important to bear in mind the fact that the difference between the work of the best and of the average man represents more to the road than the economies to be obtained from the best fuel-saving appliance or invention ever brought out.

An important opportunity for exerting a strong moral influence is available in this plan and an insight into the history of nations, political economy, the history of labor and the proper relations between employer and employee can be given. The scheme is not Utopian but practical, and the way is plain. The idea has been put by Milton P. Higgins in these words: "The object is to produce many well-trained and educated workmen, some foremen, and from the foremen a few superintendents." This structure represents a pyramid resting upon its base. As long as we seek the genius we stand the pyramid upon its apex and put it into a state of nervous equilibrium. "We may hope for much from a thousand educated, thinking expert American machinists, who have the skill, education and exact knowledge of the shops. Is not the production of 100 well-educated workmen a more certain undertaking than the production of one genius?"

We are to-day looking for the genius and overlooking the good workmen, but by providing for many workmen we cannot fail to find the necessary genius.

This school shop enterprise should be carried out for the individual, lifting each as high as he can go. It should leave the capable student prepared for a course in a technical school. An important part of the plan is a provision for sending, every year, a certain number of graduated apprentices to a technical school, for a short "sandwich" course, at the expense of the company. This should be held out as a prize or reward for high standing in the shop and school. This would provide technical men and they would be admirably prepared. Even if only one out of ten remains in the service the encouragement due to the possibility of securing such an education would affect every ambitious apprentice and every ambitious workman on the road.

It may be said that enough apprentices cannot be found. Perhaps not the first day, but when the plan becomes known there can be no difficulty. In time, perhaps, the labor unions will cease to discourage and restrict apprenticeship. At present it must be confessed that little is accomplished by the apprentices we have. If the apprentice and the apprentice's father see the possibility of education in the shop, leading to the possibility of a college training at the end, the whole shop attitude should change on this and many other matters. Some of the boys will leave the service, and well they may, for there will be many others; but places should be available, under present conditions, on every railroad for all who finish such a course.

The character and methods of the school have been considered and they may be discussed when some railroad is ready to seriously consider the subject.

Shop apprentices are prominent in the preceding paragraphs, but the need of and the demand for education lies not alone with them. Such a school would from the first be overwhelmed with applications for evening instruction of shop men and others, including foremen. Engineers and firemen will need to be provided for and the educational plan would necessarily develop into an important factor, for, in spite of themselves, railroads are sure to find it necessary to undertake the education of their men. This cannot be left to outside influence of any kind. In the hands of the officers themselves it will become a powerful instrument in dealing with the problems of the future, and especially the labor problem.

With such a system the shop could probably in time supply all firemen, engineers and men for other service, in which the education, training and the *esprit de corps*, which would naturally be developed, would

be most valuable. There is no reason why the traveling engineers should not co-operate with the teachers of the apprentice schools in the development of correspondence courses for engineers and firemen and the men would unquestionably respond, certainly as well as they do at present to the commercial correspondence schools. Having the shop schools, they may be taken to the student in every department by the correspondence method, whether he is on an engine, at a telegraph key, on the track or in an office. The development may be as broad as the need, and correspondence courses may be made a vital factor in the plan, and university extension an important element. Those who cannot attend the schools must be provided for.

Some will say, "But where are the men who can conduct such schools?" They must be the best teachers to be had and they must thoroughly understand the apprentice. These men are now doing somewhat similar work in many of our large cities and they are to be found when wanted. Some one else may say that all this has been done by the Baltimore & Ohio and proved a failure. There were reasons for that failure. The plan here outlined is believed to contain vitally important elements which have never failed, perhaps because they have never been tried. Some one will speak of the expense. The cost is insignificant. The work must not be started except upon an appropriation sufficient for ten years, which cannot be thoughtlessly withdrawn even by the directors themselves. That length of time will be required in order to give the idea a proper trial and in that time the benefits will obscure the cost.

It seems possible that the future of the motive power officer and of his department, and of other officers as well, may become clearer and the outlook may be brighter when the needs are provided for in such a way. The word education, as distinguished from instruction, seems to represent what is needed, and it is clear that the education of managements and owners of railroads is the first step to be undertaken. If this is done there will be no problem too difficult to be solved, but if not there are many impossible of solution. Only in some such way as this can the officials get close to the men directly or indirectly.

No railroad with a constantly changing policy, or one on which the tenure of official life is uncertain, should for a moment seriously consider such a suggestion as is here outlined.

Shall this (or something better) be done? The writer believes that the future, not only of the motive power officer, but of the railroads, and to a large extent of the country, depends on the answer.

There is no need of worrying about the college man, he is fully capable of taking care of himself, and it will be really a favor to him to put him entirely upon his own resources. He should not be handicapped by being labeled, because of his education. Special provision in the shops for the graduate of a technical college should not be made. Employers should not modify their methods for him. To do so is not advantageous to the college man, or to the other men in the shops.

The condition and position of the superintendent of motive power should be elevated and improved, so that young men will see that they can afford to spend their lives preparing for the highest positions. They will then be impressed with the fact that to secure such a position is worth a life time of conscientious and unwavering effort. This is not the case to-day.

Side Dump Steel Coke Car of 100,000 lbs. Capacity for the Buffalo & Susquehanna.

Coke Car for the Buffalo & Susquehanna.

The accompanying illustration shows one of a number of side-dump steel coke cars recently designed and built by the Pressed Steel Car Company, Pittsburg, for the Buffalo & Susquehanna. These cars have a number of new features and represent a distinct advance in many respects over the coke cars built by the same company for the Pennsylvania Lines West, which were described in the *Railroad Gazette*, June 26, 1903. They are of about the same dimensions as the Pennsylvania cars, being 40 ft. 5 in. long and 9 ft. 7 in. wide inside and 12 ft. high from rail to top of side, which gives a cubic capacity of approximately 3,000 cubic feet, or 100,000 lbs., assuming coke to weigh 33 lbs. per cubic foot. The doors have been made somewhat larger to facilitate the free and quick discharge of the load. By careful distribution of the metal ample strength and stiffness have been secured, while at the same time the light weight has been kept down to 47,000 lbs., which is as low as or lower than most other designs of cars of similar type and capacity. This is not at all excessive when the length, 41 ft. 9 in. over end sills, is considered. The door operating mechanism is simple and effective. There are two doors on each side, hinged at the top and the doors on each side at each end of the car are operated simultaneously with each other from a capstan on the end of a shaft projecting from the end of the car over the center of the end sill. This shaft carries a ratchet and pawl on its outer end and extends back between the center sills to about the center of the doors. Mounted on the back end is a double chain sheave carrying two driving chains wound in opposite directions, which are also wound over a double sheave on one of the door shafts. The door shafts are parallel and are located below the center sills. Immediately back of the door shaft chain sheave is a toothed pinion engaging with a similar gear on the other door shaft, so that the two shafts move simultaneously. Bent lever arms are keyed on the door shafts at three points, and to these the door links are fastened. This arrangement gives a positive opening and closing movement, and is also self-locking, eliminating any twisting moment on the shafts due to pressure of the load on the doors. The proportions of the sheaves, gears and links are such that one man can easily operate the capstan at each end of the car. Several tests have been made with the cars after they had been hauled long distances with full loads of coke during severe winter weather, and in each case the entire load was discharged in less than 30 seconds without any manual labor other than that necessary to operate the dors.

The Cincinnati Petition.

The Receivers' and Shippers' Association, of Cincinnati, Ohio, has addressed a petition to President Roosevelt and filed it with the Attorney General of the United States, asking the Administration to institute proceedings against the railroads in the Southeastern territory. What is desired is to prevent the holding by one railroad of stock in another road that reaches the same territory, whether the second road be a parallel line or one that enters the territory from an entirely

different direction; also to prevent the operation by one road of another road in the same territory and to prevent any agreements as to rates to competitive points. The petition sets forth that the Southern Railway is a combination in restraint of trade and commerce between the states within the meaning of the Anti-Trust act, Section 1, and is an attempt to monopolize, and, in fact, a monopoly of trade and commerce within the meaning of Section 2 of the same statute. The same allegations are made as to the Atlantic Coast Line, the Southeastern Mississippi Valley Association and the Southeastern Freight Association. It is alleged that the general agreement between the Southeastern Mississippi Valley Association and the Southeastern Freight Association is a contract in restraint of trade and commerce resulting in a combination and conspiracy of the parties to and the beneficiaries of such agreements in restraint of trade and commerce within the meaning of the Anti-Trust act.

The petition still further alleges that the combinations referred to are not only in violation of the Anti-Trust act, but they seriously discriminate against the commercial interests of the northern and western states in favor of the eastern states in their trade relations with the southern states, have seriously damaged the commercial interests of said states, and, if permitted to continue, will even more seriously damage these interests.

One of the chief arguments is that a combination owning or controlling railroads leading from all of the principal gateways and from all directions of the compass into a common territory of destination has the power to restrain trade and commerce among the several states as effectually as does a combination which consists of two parallel and competing roads.

The petition asks the President to instruct the Attorney General of the United States to begin proceedings in the United States courts.

"1. To enjoin the Southern Railway Company and the Atlantic Coast Line Company from acquiring or attempting to acquire further stock of railroad companies in the southern territory, and from voting the stock which they now hold in railroads other than the stock of their own companies, and from exercising or attempting to exercise any control, direction, supervision or influence whatever over the acts and doings of said other railroad companies, and to secure such other relief on behalf of the people of the United States against said illegal combinations, conspiracies and monopolies as the law and equity of the situation demand.

"2. To institute proceedings in equity to dissolve the said Southeastern Mississippi Valley Association and Southeastern Freight Association, and to enjoin the companies subscribing thereto, and all and each of them from further agreeing, combining, conspiring and acting together to establish and maintain rules, regulations and rates for carrying freight upon their several lines of railroad; and to secure such other relief on behalf of the people of the United States against said illegal combinations, conspiracies and monopolies as the law and equity of the situation demand.

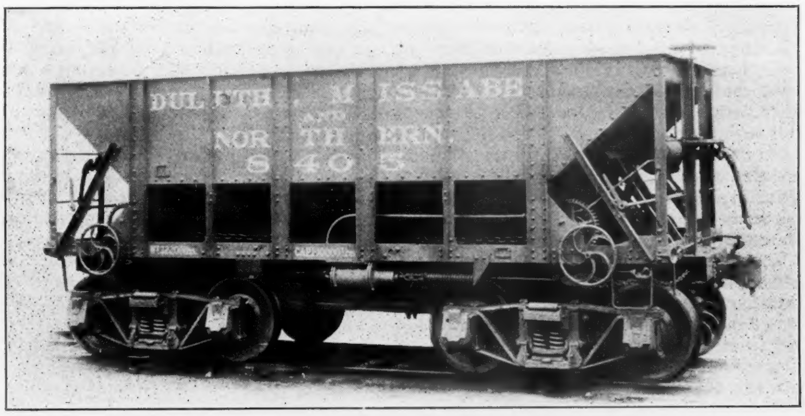
"3. To enjoin the Southeastern Mississippi Valley Association and the Southeastern Freight Association from carrying into effect the joint agreements entered into between them and from continuing to agree, combine, conspire and act together to establish, maintain rules, regulations and rates for carrying freight from the several lines of railroads whose companies are directly or indirectly parties to said agreement; and to secure such other relief on behalf of the people of the United States against said illegal contracts, combinations, conspiracies and monopolies as the law and equity of the situation demand.

"4. To enjoin the companies parties to the meeting in New York City (last December) from carrying into effect the agreements entered into at said meeting, and from continuing to agree, combine, conspire and act together to establish and maintain rules, regulations and rates for carrying freight upon their several lines of railroad, and to secure such other relief on behalf of the people of the United States against said illegal combination, conspiracy and monopoly as the law and equity of the situation demand."

100,000-lb. Ore Cars for the D., M. & N.

The Duluth, Missabe & Northern has recently received from the Standard Steel Car Company a number of 100,000 lbs. capacity ore cars, a view of one of which is shown herewith. The construction throughout is of structural steel. There are four doors operated in pairs, hung transversely across the discharge opening and so arranged as to dump between the rails. This permits the extension of the hopper back of the wheels, giving a maximum opening with short wheel-base.

The doors are supported on the outer ends by chains passing over pulleys on each side of the car above, but in line with the inner edges of the pair of doors. Each chain is operated by a shaft extending transversely across the car under the hopper at each end and is manipulated by the hand-wheel seen on the side near each end. The shaft of the hand wheel carries a pinion, which meshes into the large gear wheel on the chain-operating shaft. The two sets of doors are not moved in unison, each being operated separately from its end of the car.



Steel Ore Car—Duluth, Missabe & Northern.

The center sills are formed from 15-in. channels and the side sills from 6-in. and 10½-in. channels. The side stakes are alternately channels and angles, except at the middle, where two channels occur. The brake cylinder is hung from the under side of the side sill, and the release spring is placed on an extension of the piston rod, as plainly seen in the engraving. The auxiliary reservoir is hung under the hopper near the top of one end of the car.

The car is 22 ft. long over end sills and 20 ft. 7 in. inside of the body. The width inside is 7 ft. 11¾ in. and over all is 8 ft. 6 in. The height from rail to top of body is 9 ft. and to top of brake mast 9 ft. 6½ in. The drop doors are 6 ft. 8 in. long and 3 ft. 6 in. wide. The distance from center to trucks is 13 ft. 6 in.

The cars are mounted on trucks equipped with the Barber roller device, Simplex bolsters, Woods roller and Susemihl side-bearings and McCord and Symington journal boxes. They are equipped with Chicago and Climax couplers and Westinghouse friction draft rigging.

Car Lighting and Heating at the Congress.

The subject of lighting, heating and ventilation of passenger trains was reported for the International Railway Congress by Mr. C. B. Dudley, of the Pennsylvania, and Mr. C. Banovits, of the Hungarian state railroads. Both papers dealt with matters which are already familiar to the readers of the *Railroad Gazette;* but the discussion at Washington brought out interesting facts which are summarized below.

Lighting.—In the discussion on lighting a number of delegates told of experience with various comparatively new methods. Mr. Toltz (Manistee & Grand Rapids) told of experiments made with apparatus designed by himself and Mr. Lipschutz using acetylene compressed to 10 atmospheres, carried in receivers having fusible safety plugs. His system is in use on 36 cars of the Canadian Pacific. Mr. W. E. Fowler, of that road, said that the service was satisfactory, the lamps giving three times as much light as oil without increase of expense.

Mr. R. Fane de Salis, of the North Staffordshire Railway of England, described a process, apparently not yet in use on cars, of obtaining acetylene gas without water by mixing calcium carbide with bicarbonate of soda. With this there is no trouble from freezing.

Mr. Verlant (Paris L. & M.) has in use in cars 25,000 lamps burning ordinary gas mixed with 25 per cent. of acetylene. The use of incandescent mantles with this gas is not satisfactory, so that if mantles are to be used he thinks the acetylene might as well be left out.

Mr. Brisse, of the Eastern of France, is going to adopt the use of a rich gas with incandescent mantles. The mantles do best with a straight burner. The state railroads of Holland have used oil gas, mixed with acetylene, for eight years, but acetylene has not yet been fully accepted as safe, and the management turned to the Stone electric lighting system, which is now used on 10 per cent. of the cars. This costs 20 per cent. more than the mixed gas, without allowing for depreciation.

Mr. Salle (German Government) reported a severe explosion of acetylene which has led his government to experiment with incandescent burners.

Mr. W. Clow, of the Great Central of England, has half of his 600 cars lighted with electric lights, four-tenths of them with gas and one-tenth with oil.

On the Madrid, Saragossa & Alicante Railroad of Spain Vicarino electric lights are used on 23 cars, and Mr. Rouët de Journel reported the cost of this at 1.55 francs per 1,000 candle power per hour. Of this cost 40 per cent. is charged to depreciation and interest, 20 per cent. to operation, 15 per cent. to maintenance of dynamos, 11 per cent. to maintenance of accumulators, 7 per cent. maintenance of belts, and 7 per cent. to maintenance of lamps.

Electric lights with current generated by an axle apparatus, devised by Wittfeld and Rosenberg, has been tried with good results on the Altona Railroad of Prussia, as reported by Mr. Steinbiss.

Mr. Paul-Dubois, of the Paris-Orleans, reported satisfactory service from the Stone electric lights, which are in use on 50 cars.

Mr. Boell, of the state railroads of France, reported the adoption for principal trains of the Vicarino system.

On the Government railroads of India, as reported by Mr. Anderson, about 95 per cent. of the passenger cars on main lines are lighted by electricity, and gas is destined to

be abandoned. A peculiar advantage of electricity is that fans can be run by the same current. Three methods of electric lighting are in use. (1) The dynamo at the end of the train; (2) storage batteries; (3) the Stone system. The first method has been used for years with good results. Storage batteries are in use on one system of roads having 1,600 miles of track, with six stations for charging the batteries. The Stone system is used between Bombay and Calcutta, but there has been some difficulty in keeping the apparatus in good order, which is partly due to the scarcity of electricians in India.

In Brazil Pintsch gas has been used for a long time. Mixing acetylene with Pintsch has not been satisfactory. On the San Paulo the Stone system has been in use for 10 years with good results; but it is costly.

Heating.—Mr. Crawford, speaking for the Pennsylvania Lines West of Pittsburg, said that 200 of the 400 passenger cars on those lines now have the improved ventilating arrangement. In steam heating he had not yet found automatic regulators satisfactory.

Mr. Brisse (Eastern of France) told of experiments on that road in the use of compressed air mixed with the steam to heat long trains—a scheme invented by Mr. Lancrenom. On Parisian suburban trains 24 cars are frequently run. Compressed air is now used on all trains of the Eastern, and with it pipes of small diameter may be used.

On the Canadian Pacific, as reported by Mr. Fowler, all cars now have 2-in. steam heating pipes, and couplers of the same size. With this size the cars are kept comfortable when the temperature outside is 60 deg. F. below zero.

Mr. Ronayne, of the New Zealand Railways, told of experience in parts of that country where the air is full of fine white dust. All cars have double windows and air is admitted to dining cars through a strainer, and in many cases it is cooled with ice. This arrangement is said to be very satisfactory.

Master Mechanics' Committee Reports.

The committee reports of the Master Mechanics Association cover a wide range of interesting subjects. A digest of each is given below.

SHRINKAGE ALLOWANCE FOR TIRES.

The report takes up the question "Is the present allowance for shrinkage of tires of $^1/_{80}$ in. per foot sufficient for large diameter wheels with cast-steel centers?" The committee sent out the usual circular of inquiry to the members of the Association. After carefully considering the subject and the number of locomotives represented by the different roads which have answered the circular, the committee is of the opinion that a change in shrinkage allowance for large-diameter wheel centers would be advisable. It recommends that the present shrinkage of $^1/_{80}$ in. per foot of diameter be retained for all centers of cast-iron and cast-steel less than 66 in. diameter, but $^1/_{60}$ in. per foot of diameter be used for cast-steel and cast-iron centers 66 in. and over in diameter. The consensus of opinion is that the design of wheel centers, especially those of cast-steel and of large diameter, has much to do with the question of loose tires. This question, including suggestions for preferred sections of spokes and rims, numbers of spokes, etc., should have further investigation, and it might be desirable to refer it to another committee.

One important point to be remembered in considering the question of cored vs. solid rims is that each pound of metal cut out of the rim opposite the counterbalance permits the center to be reduced two pounds, as the amount of metal has to be accounted for in the counterbalance.

That tires are rolled out or stretched when worn to, say, about 2¼ in. in thickness has been confirmed by very careful measurements made of the tires after removal. The consensus of opinions and replies indicates that most of the difficulty experienced from loose tires occurs when they are worn to thicknesses varying from 1⅜ in. to 2¼ in. Loose tires are also caused by light cast-steel centers of insufficient section of spokes and rims to resist the shrinkage of the tire. This may also be occasioned by the distance between hubs being too great, requiring the spokes to be dished. In such cases, when the tire is shrunk on, the wheel center will be dished. The suggested standard distance between hubs on locomotives for standard gage is 55 in. This allows the use of straight spokes.

Broken tires are often caused by bad shimming when tires become loose and shims and liners are used, which only partially cover the circumference of the wheel center and do not butt against one another, but leave spaces several inches long. The tire is unsupported at these points and repeated transverse bending stresses are caused at each revolution of the wheel. Broken tires are again caused by too much shrinkage caused by improper gaging, and too much emphasis cannot be placed upon the necessity of providing a first-class system of gages, both for boring tires and turning off wheel centers. These should be referred to master gages from time to time, to insure their accuracy.

A very large number of passenger locomotives in use have driving-wheel centers 72 in. in diameter. The Master Mechanics' standards are 70 in., 74 in., etc., and the committee would recommend including 72 in. diameter tires among the standard sizes.

The question of limit of thickness of tires for different purposes should be fully investigated and recommendations which would lead to standard limitations based on diameters, service and weight per wheel should be made.

The committee's suggestions may be summarized as follows:

(1.) An allowance for shrinkage of $^1/_{80}$ in. per foot of diameter should be made for cast-iron and cast-steel centers less than 66 in. in diameter.

(2.) An allowance for shrinkage of $^1/_{60}$ in. per foot of diameter should be made for cast-iron and cast-steel centers over 66 in. in diameter.

(3.) Minimum thickness of tires should be established, due consideration being given to the diameter, service and weight per wheel.

(4.) Tire and wheel gages should be heavy enough to resist bending and should be frequently inspected to insure accuracy.

(5.) Wheel centers 72 in. in diameter should be included in the standard sizes.

(6.) Wheel center rims should preferably be uncut, but, if cut, slots should be machined out and closed with solid cast-iron liners driven in. No lead or white metal should be used.

The report is signed by F. J. Cole, Chairman; J. E. Muhlfeld, A. S. Vogt and W. A. Nettleton.

TIME SERVICE OF LOCOMOTIVES.

The committee is of the opinion that careful observation will show that the greatest opportunities for increasing the mileage of engines lie in reducing the delays in service and not in attempting to save time in rushing engines through roundhouses. Accurate records of the time spent by engines in roundhouses, waiting for trains and on the road in actual service are essential, and the committee recommends assigning an apprentice or clerk to each roundhouse to record for each engine the "time of arrival at roundhouse tracks," "time put into house," "time ready for service," "time departed from roundhouse tracks." It also recommends that engineers be required to make a trip report showing "time departed from terminal," "time for all delays and stops and cause thereof," "time switching" and "time arriving at terminal."

The committee obtained from a large number of roads data which showed wide variation in the per cent. of time taken for the various movements of an engine in and out. No definite figures can be given for many of the movements but it is worthy of note that the records of "time in road service" plus "time held at terminals ready for service" are fairly constant between 70 and 75 per cent. One road gives this figure for freight engines, accurately obtained by having special observers follow certain engines for a month at 77 per cent.

It is reasonable to conclude from the reports received that engines are ordinarily in the hands of or at the disposal of the transportation department three-fourths of the time, and that department is responsible for the large proportion of delays which so materially limit the mileage obtained from locomotives.

The accompanying table gives an actual record of one locomotive in freight service for one month. It will be seen that the total time in the hands of the motive power department was 22.6 per cent., and in the transportation department 77.4 per cent., and that the delay due to motive power while on the road constituted but 1.9 per cent. of the total time. The average running speed was 15.2 miles per hour, but the total mileage, divided by the time in the hands of the transportation department, is equivalent to only 5.7 miles per hour, and the average equivalent speed for the total time of test 4.4 miles per hour.

The report is signed by Wm. Forsyth, Henry Bartlett, J. S. Chambers, David Van Alstyne.

Record of Locomotive Service for One Engine, One Month in Freight Service; Jan. 6, to Feb. 5, 1904.

Summary.	Hrs.	Min.	Per cent.
Charged to Motive Power—At roundhouse:			
Waiting to get over ash pit	52	51	
Cleaning fires	12	06	
Coal and water	31	05	
	96	02	
In roundhouse for repairs	55	49	
Minor delays due to men	9	30	
Total time in hands of Motive Power Dept.	161	21	22.6
Transportation.			
Making up trains	10	..	
Switching	26	48	
Passing trains	132	14	
Trains ahead	40	37	
Orders	21	34	
Yards blocked	10	24	
Wrecks	7	41	
Waiting, roundhse for orders	40	28	
Coal and water on road	24	30	
Cleaning fire on road	7	33	
Sundry small delays	12	04	
	333	53	46.8
Delays due to Motive Power*	13	43	1.9
Running time	205	39	28.7
			100.0
Total time in hands Transportation Department	553	21	77.4
Time at enginehouse	201	49	
Time at yards	48	31	
Time on road	464	22	
	714	42	
Running time	198	46	

*Not steaming, hot boxes, drawbars, brakes.

LOCOMOTIVE FRONT ENDS.

At the last convention this committee asked for additional funds to carry out further tests on front ends. A letter requesting contributions was sent out by the Executive Committee of the Association and the responses were generous, a total sum of $3,035 being raised. The committee was thus sup-

plied with the necessary money and plans were made for carrying out the tests immediately at the testing plant at Purdue University. Unfortunately the testing plant has been occupied with other work so that no experiments have been made this year. Arrangements have been made, however, whereby the New York Central has kindly offered to loan a locomotive by October 15 of the present year, at which time Purdue University will make arrangements to receive it. The tests that it is proposed to make have been modified somewhat from the outline given in the 1904 report, and the committee presents the following scheme of experiments for criticism. The experiments will be carried out on a New York Central engine having large front-end diameter, which will decide the relations between large and small front-ends:

1. *Diameter of Stack.*—It is proposed to conduct tests involving four different diameters and two different heights of outside stacks, the lower stack to have a height normal to the engine, the higher to have a height 18 in. greater than this; the diameters to be 15, 17, 19 and 21 in. respectively. It is expected that data thus derived from a boiler of large diameter will serve in checking formulæ based upon results obtained from the small boiler of the Purdue locomotive, or in case they do not check, it will serve in the establishment of new formulæ. All stacks of whatever diameter or height, are similar in form. The curvature of the base is the same for all and the distance from the lower end to the point of greatest contraction is the same. Above the point of greatest contraction, all have a uniform taper of 2 in. to the foot.

2. *Inside Stacks.*—To determine the value of the inside stack, it is proposed to employ four different diameters and three different lengths, all to be used in connection with an outside stack of height normal to the engine. As in the case of the outside stacks, the inside stacks are similar in form, all being the same in the curvature of their base, the distance from the point of greatest contraction to base, and in the degree of taper of the upper portion of the stack.

3. *False Tops.*—For the purpose of determining the effect of blanking off the top of the smoke box, it is proposed to construct a false top which may be used in connection with stacks having 12 and 24-in. inside projection. Each top will have in the center a circular opening reinforced by an angle iron, this opening to be sufficiently large to admit stacks of the largest diameter. To make connection with the stacks of different diameters, filling rings will be employed, made up of two angles and a sheet-iron plate.

4. *Draft Pipes.*—It is proposed to employ single-draft pipes having diameters 13, 15 and 17 in. and lengths from 18 in. to 48 in., lengths to increase by 6-in. increments. Each increment is secured by adding a new section. Experiments upon double-draft pipes will be made to involve the apparatus already outlined. To give facility in adjusting the draft pipes, it is proposed to have them so mounted that they may be raised or lowered by means of levers extending outside of the smoke-box. Two columns having their support in an extension upon the exhaust pipe, are provided as guides for the draft pipes. The draft pipe slides freely on these columns, being applied thereto by some form of fitting which will admit of easy adjustment. The vertical position of the draft pipe is controlled by its connection with a lever arm and a shaft. The latter is supported by bearings attached to the smoke-box shell and extends out through the shell a sufficient distance to receive a counter-weight and operating lever. By having the operating lever pass over a graduated scale, it is thought that it will be possible to place the draft pipes in definite positions without the necessity of opening the front door.

The committee is not carrying out the instructions under which it was appointed, so far as experimenting on the elimination of the diaphragm is concerned; this has been shown by the experiments on the testing plant at St. Louis to be a most important factor in the proportion which the draft utilized in burning coal bears to the total draft produced, but in view of the information that has been obtained on this subject at St. Louis, the committee considers that further experiments on the testing plant would be valueless. Assuming that the first requirement is to obtain a self-cleaning front-end, it will require lengthy and practical experimenting to ascertain what design will afford the self-cleaning feature with the least obstruction to the passage of the front-end gases, and the committee feels that this subject will have to be determined by experimenting on engines in actual road service before any useful work in this connection can be done upon the testing plant.

The report is signed by H. H. Vaughan, Chairman; F. H. Clark, Robert Quayle, A. W. Gibbs, Prof. W. F. M. Goss.

WATER SOFTENING FOR LOCOMOTIVE USE.

There are two classes of waters commonly used for locomotives—scale-forming and alkalines. In both, the impurities remain in the boiler either to form an accumulating scale or a concentrating alkaline solution, or both. The scale-forming material can either be removed from the water by heat or by chemical means. There is no known means of removing the alkali. The advantages of supplying a boiler with a clean water practically free from scale-forming material are shown by the boiler records of roads fortunate in having first-class water supplies, where fireboxes last almost indefinitely and flues are reset only when the beads are worn off.

The first attempt at water purification in general railroad practice in this country was to use a boiler purge—soda-ash or some allied sodium salt—generally put into the locomotive tank. This process precipitated the scale-forming material in the boiler as mud and also tended to loosen up the scale already formed in the boiler, but it did not lessen the number of necessary wash-outs to any extent and required frequent blowing off, which did not effectually remove the mud, and, in addition, there was an accumulation of alkali in the water in the boiler not easily controlled. Theoretically a boiler purge for purifying water in the boiler was nearly perfect, but practically it was not so successful. Treatment of water in the boiler has the advantage of being cheap, and that is all.

In order to obtain pure water the practice of purifying the water before it enters the boiler has come into extensive use. The lime and soda-ash treatment has been used in some form or other for a great many years, but the mechanical devices for making the process successful, as well as economical, are of recent origin. All those in use operate on one principle, namely, using enough soda-ash (sodium carbonate) to precipitate the sulphates of calcium and magnesium as carbonates, and enough slaked lime (calcium hydrate) to neutralize the carbonic acid existing as free carbonate and bicarbonate, precipitating all of the carbonates of lime and magnesia in the water and also precipitating as carbonate all of the hydrate of lime added in the treatment process. The process is theoretically perfect and in practice leaves so little scale-forming material in the water that the beneficial results are most apparent.

There are two systems of treating waters; the continuous and intermittent.

The continuous system consists of a device for mixing the required quantity of slaked lime and soda-ash in the water as it flows into a receptacle of such size that the slow flow of the water permits the precipitated scale-forming material to settle out, delivering continuously the purified water. Some continuous processes apply a filter to make sure that the sediment is removed from the water. This is believed to be a valuable addition to any plant where such a filtering process would be considered an addition. The advantage of the continuous process is that it takes up a minimum ground space.

The intermittent system consists of treating the water and letting it settle and pumping the purified water from the top of the settling reservoir, using a floating intake pipe. The advantage of this system is low first cost. The settling process requires agitating machinery and time, and a settling plant cannot be forced beyond its capacity without jeopardizing the quality of the purified water.

In both systems the cost of chemicals is the same for a given water. The labor cost ought to be the same, if the men doing the pumping can be located so they can attend to the filter as well as the pumps.

Muddy waters are easily cleared of the greater part of the suspended matter, but it is almost impossible to render them absolutely clear unless a coagulant—ferric hydrates or alumina—is used. The slight murkiness in treated muddy water is not seriously objectionable, however.

Filtering plants are more complicated and more expensive than either the continuous or intermittent systems and usually depend upon a partial settling in order to relieve the filters from becoming quickly clogged. They deliver the cleanest water of any of the purifying processes, but it is a question whether the water is enough better to warrant the increased cost.

The quality of waters which can be treated successfully and with great benefit to locomotive boilers are those which contain mud, sulphates of lime and magnesia, and carbonates of lime and magnesia, or which contain salts of iron and free acid. Many alkali waters contain large quantities of incrusting solids. These can be removed, but the alkali remains and increases by the amount of soda-ash used. If the water is high in alkali, it will give trouble from foaming, and the probability is that it will be more economical to find a better supply somewhere else that can be treated successfully. The results obtained from the treatment of dolomite waters are entirely successful, resulting in better steaming engines, greater tonnage hauled and a marked reduction in engine failures from leaking flues.

Analyses of waters containing from 5½ to 60 grains of incrusting solids per gallon show reduction after the treatment to from three to five grains of incrusting solids per gallon.

Alkali waters are those containing salts of sodium and potassium in solution, and there is no known chemical means of removing these salts. There are a number of compounds on the market which claim to relieve troubles from foaming with alkali waters and some of them are partially successful. The only way to get rid of alkali is to remove the alkali from the water. This can be accomplished by distillation, but up to the present time the cost of plant and comparatively high cost of product make the process prohibitive for railroad use.

A purifying plant, 500,000-gallon capacity daily, can be erected for from $6,000 to $10,000, according to the process used, and the water successfully treated for scale-forming

material, for from ¾ cents to 4 cents per 1,000 gallons, depending upon the quality of the water.

By the use of pure water, boiler troubles are reduced to a minimum. One railroad reports that the number of trains abandoned on account of leaky flues was reduced from 27 to two in a stated period. Another reports that passenger trains delayed on account of leaky flues on a division using purified water have been reduced from 12 to 15 per month, to one and two, and an occasional month with no failures. A road handling 60 engines per day has reduced its boiler-maker force from four men to two men—one day and one night—and these men have to be given machinist work to keep them busy.

The committee does not recommend the use of compounds to be introduced into the boiler where there is a possibility of purifying the water before it reaches the boiler.

The committee believes that the cost of purifying water for locomotive use is more than saved by the reduction in the labor cost of caring for boilers in the roundhouse, and the benefit gained by freedom from leaky flues and poorly steaming engines on the road is all profit.

The report is signed by J. A. Carney, Chairman; L. H. Turner, F. N. Risteen, J. F. Dunn, Robert Quayle.

LOCOMOTIVE TERMINAL FACILITIES.

This committee was asked to report on (a) "What can be done to reduce locomotive terminals to the basis of a machine for treating and handling engines apart from the matter of housing, the object being the prompt handling of motive power, greater efficiency in service and less detention at terminals, while affording more time and better facilities for the care and repair of engines" and (b) "To investigate the best methods of heating and ventilating roundhouses."

(a) Location is a very important factor in most instances, and considering the fact that any change that would need to be made to existing facilities would have to be adapted to the conditions existing in the matter of location, space, drainage, etc., the committee has taken, as an example in one instance, an old plant, made over from a very awkwardly situated and poorly equipped terminal into one that is up to date, and another that is a good example of a new and efficient plant.

Plan No. 1 is shown as the "old plant made over." It will be noted that the space available at the time the change was made was very limited, and the engineering department had to work close to fit conditions. A description of the plant is as follows:

The coming-in track, upon which all engines are left by the road crew.

An elevator track, stubbed at one end and with sufficient rise for its whole length in the clear, to enable elevator men to move cars on or off the hoppers at will by the manipulation of the hand brakes and perhaps a little start with a pinch bar. Power is also provided for the movement of cars on and off the hopper, but is seldom used.

Clinker-pit tracks Nos. 1 and 2, both of which run to the turntable direct, and the depressed track for cinder cars, the approach of which is laid on a two per cent. grade.

The coal elevator, which is the latest improved type of the Link-Belt Company, has a capacity of 500 tons.

The sanding boxes are placed as follows, one on the corner of the coal elevator adjoining the clinker-pit track No. 1, and another adjoining clinker-pit track No. 2 on the corner of the sandhouse proper. The sanding of the engines is done by means of drop pipes which are handled by hostlers, the time required for filling the largest boxes being about 15 seconds. The sandhouse is equipped with three stove dryers, and sand is elevated into sanding boxes by means of compressed air. Storage is provided for about 12 carloads of wet sand, which is unloaded from cars placed on the sandhouse and storing tracks. The sanding box on clinker-pit track No. 2 is large, having a capacity of about ten cubic yards, and out of this box sand needed for outside points is loaded into cars placed on the sandhouse track, by means of a drop spout or chute. Nine or ten yards of sand can be loaded in this way in a few moments.

Each of the clinker-pit tracks is provided with a 10-in. water column and tenders are filled very quickly, the filling of tenders being the last operation before engines are put on the turntable. This is not as the plant was planned, it being intended that the knocking out of the fire should be the last operation, but conditions of space made that impracticable.

The cross-section of the clinker-pit track shows the general plan, the inner rail (100 lbs. per yard) being supported on cast-iron piers which are jacketed with No. 10 iron, the remaining space on the inside filled with concrete, tie rods at 10-foot spaces being provided along the open space of the clinker tracks to prevent possibility of rails spreading. The clinker pits and depressed track are of solid concrete and good drainage is provided. Two hydrants are provided on each clinkering track for wetting cinders and a steam pipe is provided for thawing out ash pans and grates when that is needed.

In preparing this plan it was sought to make it as near a "machine" as possible and the results obtained during the past winter were not disappointing in that respect.

Engines arriving off the road are left on the "coming-in track," and when they come in in quick succession, as is the rule in winter or during any season of heavy traffic, no attempt is made to coal all of them on the north side of the elevator, hostlers usually alternating, that is, one is coaled on the north side and the next on the south side, or if necessary, several engines are taken off the coming-in track at once and coaled on clinker-pit track No. 1. In this way it will be observed that when necessary to get hold of, say the sixth engine in line, the first five engines can be taken at once on to clinker-pit track No. 1, and the engine that is most desired can then be coaled on the coming-in track, after which it can be taken around on to clinker-pit track No. 2, sanded, clinkered, watered and housed, in from 15 to 25 minutes from the time of its arrival.

All engines when going out for trains use a track provided for that purpose alone and in no way interfere with the putting in of engines, except when on the table. The outgoing track is also provided with a water column to serve engines leaving the house.

The regular equipment of men is six hostlers and six clinker-pit men, three of each for the day and night shifts respectively, and 100 engines are handled in 24 hours without difficulty or rush.

In addition to the duty of clinkering, the clinker-pit men also attend the switches at the west end, unload the wet sand, run the dryers, elevate sand to the sanding boxes, attend to water columns and shovel the cinders on to the cars on the depressed track.

The equipment of men for the coal elevator is one elevator man, one dumper and one loader for each of the day and night shifts, or seven men all told, including the fuel foreman.

At the present time coal is being handled from the car to the tender for $3^{1}/_{10}$ cents per ton, and this could be reduced considerably if enough coal was used to keep the help around the elevators busily employed.

This plant approaches closely to the "machine" idea and is of sufficient capacity to handle 200 engines per day of 24 hours without difficulty.

Plan No. 2 provides a set of tracks upon which incoming engines can be spotted by the road crew, where they are left until the hostlers take them out for coaling, clinkering and housing. The object of the spot tracks is to permit the last engine to be the first one housed, if such is desired. This plan, it will be noted, requires much space, longitudinally at least, and perhaps could not be utilized at all points on this account. We quote in full the recommendations of

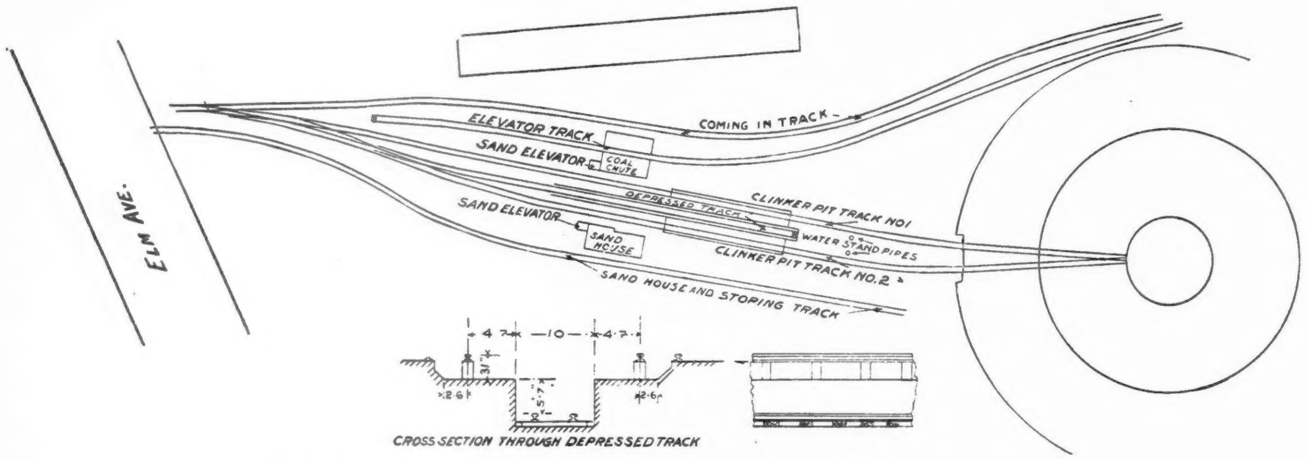


Fig. 1—Layout of Michigan Central Engine Terminal at Jackson Junction, Mich.

Mr. W. R. McKeen, Jr., the designer of this plan:

"Railroads at large are just commencing to realize the importance and necessity of adequate roundhouse facilities. Efficient results from roundhouses have always been demanded, but necessary facilities have, as a rule, been sadly neglected. Following are some of the important facilities a roundhouse should have:

"1. What is known in the yard language as a 'spot'—a system of tracks connected to the inbound track in the yard, also connected to the main coal track leading to the roundhouse table; this system of tracks to be so designed as to enable at least ten engines to be delivered by inbound engine crews, any one of which can be moved to the coal chute in preference to the other nine at any time.

"2. An outbound 'spot' track and a water crane, so that outbound engines could take a full tank of water just before leaving; also water cranes so that inbound engines could take water immediately after taking coal.

"3. A double cinder pit and means of wetting down and cleaning ash pans economically.

"4. Method of loading cinders into the ordinary steel car equipment by means of conveyors.

"5. Turntable not less than 85 ft. with (preferably) an electric motor as power for handling same.

"6. Door with at least 35 per cent. glass for lighting purposes; also locks at top and bottom and posts so that same could be locked open as well as locked shut.

"7. Smoke-jacks so arranged that engines could be moved a quarter of a turn and equipped with suction ventilators so that the harder the wind the stronger the up-draft.

"8. A system of ventilators on top of the roundhouse for catching the steam and other waste products from a locomotive.

"9. Water pipes, air pipes, blow-off pipes, steam pipes and a good-sized steam supply pipe and taps for these for each pit.

"10. A permanent, sanitary, dry floor; not a gravel or cinder floor, but a concrete foundation with wooden blocks set on edge, filled in between with tar and cement, and so fitted in as to drain any water into the pits.

"11. A tool room for the care of all general roundhouse tools.

"12. A washroom for engine crews, lockers for their extra clothing, etc.

"13. Centrally located office and telephone facilities for the foreman.

"14. The low, flat roof of roundhouses is to be discouraged on account of the drippings in cold weather, and the impossibility of properly ventilating same."

The objections to plan No. 2 are as follows:

First.—Too many switches to look after and too much switch cleaning for the engineering department to attend to at times, when, owing to snow storms and extreme temperature, the limited number of men usually available for such purposes is kept busy keeping yard tracks open for operation.

Second.—A switchman would necessarily have to be provided to attend "spot" switches.

Third.—Conveyors for loading cinders are rather expensive, often out of order when most needed, and as a rule unnecessary; the depressed track for cinder loading being free from breakdowns and always in shape to use. Modern steel cars are not suitable for cinder work, inasmuch as the bottom dumps provide a poor means of distributing cinders along the right of way for ballast, for which purpose, in most cases, they are used.

Fourth.—The coal elevator and sandhouse should not be as closely adjacent as this plan provides.

Fifth.—The cinder, or clinker pit, should be located on the house track as near to the door as possible, in order to curtail the handling of engines without fire, to the minimum.

Sixth.—Incoming tracks and outgoing tracks should be as distinctly separate as possible, otherwise delays will be common to ongoing engines unless the tracks shown at EE and FF are double, in which event more switch throwing would be necessary, which is an operation that should be eliminated as far as practicable.

With the exception of the above features, the general idea shown in Plan No. 2 is good, and would certainly provide a means of handling power very promptly.

The matter of facilities, as above described, is not all that goes to make for promptness and despatch in handling of power, however. Grate rigging that is out of order, grates that do not open enough, and inadequate means for thawing out frozen-up ash pans, etc., being very important factors. Drainage along the incoming track should also be specially provided for in order to escape trouble in cold weather from ice building up from the drips common to the use of heaters and the working of injectors.

Regarding heating and ventilating of roundhouses, the committee can offer no suggestion for an improvement over the plant of the Lake Shore & Michigan Southern at Elkhart; this, in the committee's opinion, being almost perfect.

The report is signed by D. R. MacBain, Chairman; C. E. Chambers, P. Maher, W. R. McKeen, Jr.

"WHAT SHOULD BE THE PRACTICE UNDERLYING THE PROPER LOADING OF LOCOMOTIVES ON THE BASIS OF CONDUCTING TRANSPORTATION WITH THE GREATEST EFFICIENCY AND AT LEAST COST—CONSIDERING ALL THE FACTORS INDIVIDUALLY?

This very broad subject has been approached by the committee in a general way. The factors to be considered are almost innumerable and vary widely with different conditions in different parts of the country. After carefully analyzing the replies received in response to a circular letter of inquiry, the committee has laid down certain general conclusions as follows:

The important factor underlying the proper loading of locomotives is the length of time which may be used in hauling a train over a controlling section of the road; this controlling section may be an opposing grade, a stretch of single track in an otherwise multiple track line, distance between sidings, etc. As the time may be longer, or shorter, so may the loading of the locomotive be heavier, or lighter. The length of time having been fixed, the next two important factors are the power of the locomotive and the resistance of the train.

The power of the locomotive may be calculated with a reasonable degree of accuracy, but without knowing the peculiar conditions of each case it is impossible to say what allowance should be made for the condition of the locomotives, for the water, the fuel and for the almost innumerable items, some of which need attention in each locality.

The train resistance contains a greater number of variables than enter into the calculations of the power of the locomotive; the number of cars and their condition, track conditions, atmospheric conditions and others. When the rating is very accurate the total tonnage should be ascertained by more accurate means than those prevailing at the present time in many places.

There is a means of checking the calculations of locomotive power and of train resistance—the dynamometer between the tender and the first car in the train, and it is recommended that this be used. Calculations are good, but it frequently happens that the basis of the calculations is wrong. For instance, the grades may not be what the profile data show; the elevation on curves may have more serious effect than assumed; the resistance per ton and per car may differ from the assumptions, and the locomotive may give results different from the assumed ones.

The operating department and the motive power department ought to take equal interest in the proper loading of locomotives.

As an appendix to the report the committee has included a brief synopsis of the replies of a number of motive power officers

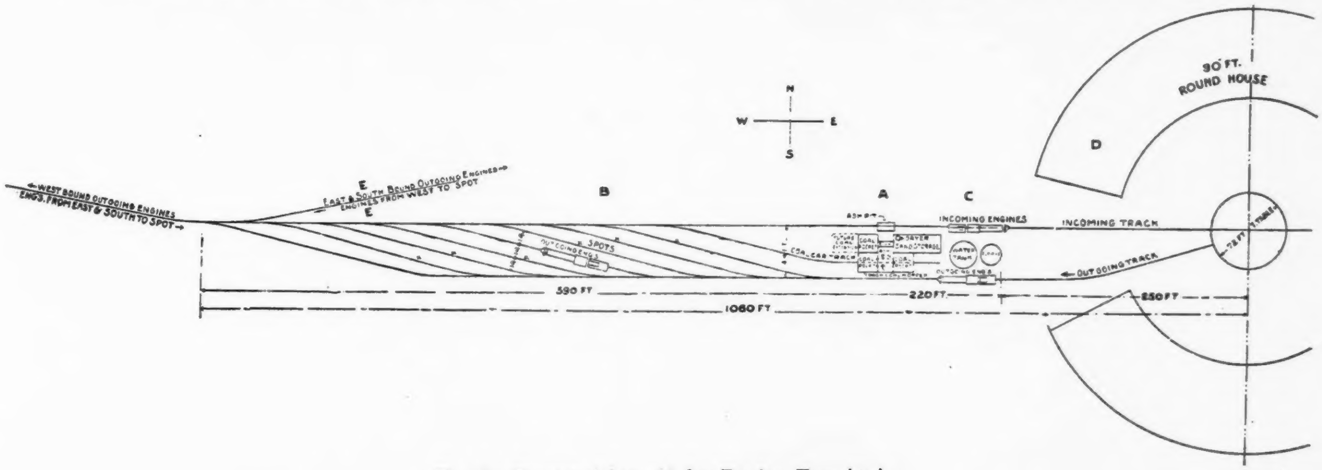


Fig. 2—Proposed Layout for Engine Terminal.

giving their views on the subject, and a bibliography of important papers in the technical journals and in the proceedings of the various railroad clubs and engineering societies.

The report is signed by C. H. Hogan, Chairman, H. T. Herr, D. F. Crawford and H. T. Bentley.

LOCOMOTIVE TESTS OF THE PENNSYLVANIA RAILROAD AT THE ST. LOUIS EXPOSITION.

The committee consisting of F. H. Clark, H. H. Vaughan and C. H. Quereau which was appointed by the Association to serve on the Advisory Committee of the Pennsylvania Railroad, reports that it is not yet in a position to make a final report inasmuch as the tests of the eight engines made on the plant have not been completely worked up. The committee expects to make a final report at the convention next year.

SUBJECTS.

The committee on subjects to be investigated and reported on for the coming year suggests the following:

Individual Papers.

1. The more general application of white metals for bearings of locomotives.
2. Special valve gears, such as the Walschaert, Alfree-Hubbell, Young, etc., compared with the ordinary Stephenson link motion. Paper by C. J. Melin.
3. Fire kindling; cost of material, labor and time kindling fires in locomotives, with both anthracite and bituminous coal. Paper by F. F. Gaines.
4. Superheating steam in locomotive practice. Paper by F. J. Cole.

For Investigation by Committees.

The suggested members of each committee follow the subject.

1. Best method of welding and repairing locomotive frames without taking down or removing from the engine. William Garstang, C. H. Quereau, G. W. Wildin.
2. Organization of the mechanical department, with special reference to the question as to whether the mechanical department or the transportation department should employ, examine, promote, govern and discipline locomotive firemen and engineers. D. Van Alstyne, J. H. Manning, G. M. Basford.
3. What can be done to establish a general understanding of a uniform method of designing repairs on locomotives in railroad repair shops, in order that reliable comparisons can be made as to the efficiency of various shops on any one system, or possibly as between the shops of various systems or roads. H. H. Vaughan, R. Quayle, C. W. Cross.
4. Engine house running repair work on locomotives; what is considered the best practice for doing this work, handling reports, etc., made by foremen, engineers, road foremen of engines, and inspectors, and with what machine tools and hand tools should the roundhouse be equipped to get the best results? A. E. Mitchell, F. T. Hyndman, J. W. Luttrell.
5. Locomotive lubrication; general consideration of the subject, with reference to high steam pressures and superheated steam; how far may we economize in lubrication, both internal and external; also consider standard fittings for lubricators; consider question of sight-feed lubricators versus pumps for internal lubrication. E. D. Bronner, R. F. Kilpatrick, D. Van Alstyne.
6. Specifications covering cast-iron to be used in cylinders, cylinder bushings, cylinder heads and steam chests; also the question of substitution of cast-steel for locomotive cylinders, the idea being to secure lighter section with better material. G. R. Henderson, E. D. Nelson, Max Wickhorst.
7. Results obtained from water-purifying plants. L. H. Turner, H. T. Bently, W. R. McKeen.

The report is signed by J. F. Deems, Wm. McIntosh, R. D. Smith.

LOCOMOTIVE DRIVING AND TRUCK AXLES AND LOCOMOTIVE FORGINGS.

This committee was appointed in 1902 to draw up specifications for locomotive driving and truck axles and locomotive forgings, with instructions to defer its final report until after the Washington meeting of the International Railway Congress. It has carefully considered the recommendations and discussion of the meetings of 1903 and 1904, and now presents the amended specifications given below for consideration and approval. The committee has conferred with representatives of the American Society of Mechanical Engineers and with members of Committee "A" of the American Society for Testing Materials, and a compromise specification has been suggested which it is believed will be satisfactory to each organization, except as noted below for this Association. This compromise specification involves a change in the reduction of area from 35 per cent., as originally recommended by this committee, to 25 per cent. It also involves the bending test covered in the last report, specifying a 1-in. by ½-in. test piece bent cold, 180 deg. over a bar 1 in. in diameter. This test is recommended by

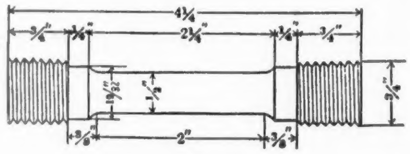


Fig. 1.

both the American Society of Mechanical Engineers and the American Society for Testing Materials. The committee, however, feels that it is not desirable, as it is hardly possible to get a 1-in. x ½-in. test piece without drilling a larger hole than it would care to recommend, and it believes further that the bending test is not essential, but that the information that would be derived from such a test would be more satisfactorily covered by the requirements for elongation and reduction of area. If, however, the members of the Association feel that the bending test should stand, the committee will not object to having that test included in the specifications, but would suggest in that case, the desirability of making the test piece ½ in. square, instead of 1 in. x ½ in. in section.

The committee calls attention to the manner of taking the test piece by means of the tools described in the progress reports of 1903 and 1904, and especially to the drill submitted by Mr. J. F. Kincaid, of the American Locomotive Company, in the discussion of the report of 1904; also to the arguments in favor of the test piece taken by means of a hollow drill, which for convenience are restated below:

1. The physical test outlined is one which should insure proper hammer work.
2. It does not show the manufacturer which axle is to be selected for test.
3. The axle tested is not destroyed, but is available for use if it meets the requirements.
4. The test may be used in the purchase of small lots, most orders from railroad companies being for from six to ten axles.
5. The test does not require a discard and in no way adds to the cost of the axle.
6. It furnishes the manufacturer with a check of the work done in his plant.
7. The test is one largely used by the United States Government for forgings.

The specifications shown below will insure good material, and it is recommended that the specifications be adopted and the committee discharged.

The report is signed by F. H. Clark, Chairman; J. E. Sague, S. M. Vauclain, L. R. Pomeroy, F. W. Lane, E. B. Thompson.

Proposed Specification for Locomotive Driving and Engine-Truck Axles.

Material.—Open-hearth steel.

Chemical Requirements.—Phosphorus, not to exceed .05 per cent.; sulphur, not to exceed .05 per cent.; manganese, not to exceed .60 per cent.

Physical Requirements.—Tensile strength —not less than 80,000 lbs. per sq. in.; elongation in two inches—not less than 20 per cent.; reduction in area—not less than 25 per cent.

Tests.—One test per melt will be required, the test specimen to be taken from either end of any axle with a hollow drill, halfway between the center and the outside, the hole made by the drill to be not more than 2 in. in diameter nor more than 4½ in. deep. The standard turned test specimen, ½ in. in diameter and 2 in. gage length, shall be used to determine the physical properties. (See Fig. 1.)

Drillings or turnings from the tensile specimen shall be used to determine the chemical properties.

Stamping and Marking.—Each axle must have heat number and manufacturer's name plainly stamped on one end, with stamps not less than ⅜ in. high, and have order number plainly marked with white lead.

Inspection.—All axles must be free from seams, pipes and other defects, and must conform to drawings accompanying these specifications.

Axles must be rough-turned all over, with a flat-nosed tool, cut to exact length, have ends smoothly finished and centered with 60-deg. centers.

Axles failing to meet any of the above requirements, or which prove defective on machining, will be rejected.

Proposed Specifications for Locomotive Forgings.

Material.—Open-hearth steel.

Chemical Requirements.—Phosphorus, not to exceed .05 per cent.; sulphur, not to exceed .05 per cent.; manganese, not to exceed .60 per cent.

Physical Requirements.—Tensile strength —not less than 80,000 lbs. per sq. in.; elongation—not less than 20 per cent. in two inches; reduction in area—not less than 25 per cent.

Tests.—One test per melt will be required, the test specimen to be cut cold from the forging, or full-sized prolongation of same, parallel to the axis of the forging and halfway between the center and the outside.

The standard turned specimen, ½ in. in diameter and 2 in. gage length, shall be used to determine the physical properties. (See Fig. 1.) Drillings or turnings from the tensile specimen shall be used to determine the chemical properties.

Stamping and Marking.—Each forging must have heat number and name of manufacturer plainly stamped on one end with figures not less than ⅜ in. high, and have order number plainly marked with white lead.

Inspection.—All forgings must conform to drawings which accompany these specifications, and be free from seams, pipes and other defects.

Any forgings failing to meet any of the above requirements, or which prove defective on machining, will be rejected.

Proposed Specifications for Steel Blooms and Billets for Locomotive Forgings.

Material.—Open-hearth steel.

Physical Requirements.—Grade "A": Tensile strength, 70,000 lbs. per sq. in.; elonga-

tion in two inches, 20 per cent. Grade "B": Tensile strength, 80,000 lbs. per sq. in.; elongation in two inches, 17 per cent.

Chemical Analysis.—Grade "A": Carbon, .25 to .40 per cent.; phosphorus, not to exceed .06 per cent.; sulphur, not to exceed .06 per cent.; manganese, not to exceed .60 per cent. Grade "B": Carbon, .35 to .50 per cent.; phosphorus, not to exceed .05 per cent.; sulphur, not to exceed .05 per cent.; manganese, not to exceed .60 per cent.

Tests.—One test per melt will be required, the test specimen to be cut cold from the bloom, parallel to its axis and half-way between the center and the outside. The standard turned test specimen, ½ in. in diameter and 2 in. gage length, shall be used to determine the physical properties. (See Fig. 1.) Drillings or turnings from the tensile specimen shall be used to determine the chemical properties.

Stamping and Marking.—Each bloom or billet must have heat number and manufacturer's name plainly stamped on one end, with stamps not less than ⅜ in., and have order number plainly marked with white lead.

Inspection.—Blooms and billets must be free from checks, pipes and surface defects. Any blooms or billets chipped to a depth greater than ½ in. will be rejected.

Any billet or bloom failing to meet the above requirements will be rejected and held subject to disposal by manufacturers.

Inspector to have the privilege of taking drillings from the center of the top bloom or billet of the ingot in order to determine the amount of segregation.

Grade "A" is intended for rod straps and miscellaneous forgings.

Grade "B" is intended for driving and truck axles, connecting rods, crank pins and guides.

SHOP LAYOUTS.

Few roads are so situated that one shop could take care of all their heavy repairs even if that were desirable, which we believe not. We do not at this time wish to take a stand for or against the large shop, meaning the extreme size possible. That question must be determined by the road or system for itself, viewing the question from the standpoint of road layout, organization, labor facilities, etc. The very large shop presents an opportunity for tying up the road by fire, strikes or accident that is not present when several smaller shops are used. On the other hand, it is hardly feasible to provide the smaller shops with all of the facilities and refinements now thought essential in the equipment of the large shop, and by these we mean not only the machine tools and handling appliances, but the multitude of small tools and appurtenances not generally reckoned or appreciated. Many roads lack proper repair facilities at terminals and division points where the "stitch in time" saves many an engine failure. No matter how large and complete the main shop may be, the outlying points can advantageously and profitably use a moderate tool equipment for taking care of running and light accidental repairs, leaving heavy repairs and manufacturing to be done at the main shops. With such an equipment and organization, we believe that relatively small shops are undesirable, expensive and unprofitable, and that the larger, completely equipped main shops will handle the repairs in the most satisfactory manner.

The railroads represented in this Association have all kinds of shops, many of them capable of improvement, and in the last few years there have been a number of large shops built, no two on the same general plan, yet embodying more or less of the strictly modern lines of improvement in buildings, equipment and facilities. Railroad managements, owing perhaps to traditional conservatism, have not been quick to grasp the improvements in shop processes and equipment that are deemed essentials in other lines of business. It is true that railroads are not manufacturers, as a rule; but, if the repairs of locomotives and cars involve the same processes to a great extent as in their manufacture, either the manufacturers of railroad equipment and machinery are unduly extravagant in providing roomy, well-lighted buildings, traveling cranes and hoists, electric transmission of power and lighting, special tools of latest designs, all tending to labor-saving or putting the workmen on a better plane, or else the railroads are neglecting their opportunities and are daily paying for it in the increased cost of their repairs.

Most of us, doubtless, have visited many shops where locomotives, cars and heavy machinery are built, and we could not help contrasting the methods of the successful manufacturers with those of the average railroad shop. If we analyze the matter and seek the reasons governing the situation on railroads, we find, first of all, that the average shop is planned and equipped for handling the average locomotive of say 10 or 15 years ago and with machinery, much of it, of a greater age. During that period we have increased steam pressure 25 per cent., increased tractive power 50 per cent., increased total weight 75 per cent., and tank capacities of 7,000 and 8,000 gallons are now common, an increase of nearly 100 per cent.

The demands of our managements for high-speed and heavier tonnage to meet competition have brought about the development of machines for hauling trains that put the crack engines of a few years ago on the branch lines and on second-class trains or in the market for sale, to make way for heavier power. Wheels under the engines have been multiplied and so have cylinders. Rods are now so heavy that it takes a gang of men to handle them. Everything about the engines is on a larger scale, but how about the shops?

It is quite plain to our managements that it takes twice as long to water an engine with the 6-in. stand-pipes that were good enough in the old days and they see the necessity for enlarging on that line to cut down time. Is it not equally important to supply facilities for handling the locomotive parts that have perhaps doubled in weight since the old shops were built? It used to be considered good enough to jack up an engine or, perhaps, to have a drop table for wheeling, and we are still doing too much of it, a practice that would be ridiculed by any live business man whose profits depended on modern methods of handling.

Now, whose fault is it that so many railroad shops are behind the times? It may be the fault of the management in not approving the recommendations of live motive power officers, who are awake to the situation and see their maintenance expense rising and are unable to check it on account of lack of facilities. The heavy modern engines do not stay out like the old timers and shoppings are more frequent, demanding greater shop facilities for a given number of engines than was necessary when engines were lighter, trains were shorter and time was longer. Some roads may think they are too poor to make these expenditures, and, of course, they should have our sympathy if this were true, but it is not.

Based on the principle that a manufacturing business will be most profitable when conducted with a plant, equipped with modern appliances, labor-saving devices for economical production, well organized and rationally directed, a railroad shop to be most efficient should be equally well equipped, organized and directed. It is stated, however, in some quarters, that although the argument may be good, it has not been proven by the results obtained at the large modern shops, and that many old shops are yet more efficient than the new. It must be admitted that there is much of truth in this, but for reasons which, perhaps, can be explained.

Some shops have been built in which the money has been expended for ground and buildings and then these are filled with "back-number" machinery. In this case, aside from improved facilities for handling, no gain in the cost of the machine work is accomplished. A road with such a shop will need to make purchases of extra motive power in order to do business. When buying engines, if they would cut off one or two and expend their value in tools, the balance of the power could then be brought up to standard so that the extra engines cut off would not be needed. It is not a question of how many engines a road has, but how many good, serviceable engines, and this depends on the facilities for repairing and keeping engines running. In this connection it is suggested that a system of cost keeping for manufactured work and various operations will shed much light on the comparative value of old and new machinery. The use of high-speed steels has made large economies possible, the exact amount of which can only be determined by an accurate cost-keeping system, which can very profitably be carried out in the larger shops.

Another example is a shop, equally well located and built, and equipped with a large line of modern tools, new from the makers. The shop is started and the management expects immediate results and they are not forthcoming. Why? Because the shop lacks that important equipment of the old shop in small tools, cutters, mills, jigs, formers, templates, bars, blocking, clamps and handy appliances that the old shop has been years in accumulating. The new shop will be handicapped for lack of these for some time, as they are an unappreciated asset in the business of the old shop.

Other well-equipped shops have been built at new points where the management deemed wise to locate, but almost invariably this has been the cause of long delay in getting together an organization to work the shop up to its capacity. Railroad shop work cannot be successfully performed by the floating element. A large proportion of the force must be permanent, settled in homes, convenient to schools and churches and other advantages and have something to live for beyond the empty honor of being an employee of the railroad.

No matter how well built and equipped the shop may be, its efficiency will be measured to a great extent by the class of men that can be obtained to work in it. Unless the railroads are wise enough to see to it that they must, to a certain extent, bring the shops to the men, they will fail in getting the best material. In order to get and hold the proper class of men, shop work should be fairly constant. Frequently the motive power department is embarrassed by the difficulty in getting appropriations for maintaining force and organization at times when business is slack. When business is good, engines are worth from $25 to $50 per day, or perhaps more, and every day in the shop or out of service is that much loss. When business is dull and the full locomotive equipment is not needed, the engines needing repairs could then be put through the shops and laid up ready for the return of business. By thus keeping engines up, a less number is needed, investment being devoted to maintenance, instead of multiplication. There is no questioning the results of having a uniformly good standard of equipment, as against a lot of cripples,

helped out with occasional new engines, often of new design, requiring time and considerable expense in getting patterns and repair parts.

The matter of recruiting for shop forces is one that is assuming considerable importance. We are not now making the all-around mechanics, which were employed some years ago, equally at home on the machines, the bench or on the floor. The apprentice question is a vital one, deserving the attention of not only the motive power officers, but the higher officials, as well. As the older methods seem to be outgrown, new methods of recruiting must be tried, including, possibly, educational courses in connection with the shop work.

The difficulty of getting suitable men for foremen in smith shops and boiler shops is particularly noticeable. The spirit which at present dominates workmen is one apparently not elevating the more worthy or ambitious ones among them, but rather establishing a dead level of mediocrity from which it is difficult to select leading men for foremen and places of responsibility. Some of this has been brought about by the increasing distance between the officers and the men, due to increase in the size of railroads, in many cases now amounting to many thousand miles and a vast number of men. Formerly a motive power officer knew almost every man on his pay-roll, and this personal contact, although not necessarily amounting to familiarity, nevertheless contributed to a spirit of *esprit de corps* that was invaluable in preserving organization, conserving good feeling and enabling prompt settlement of all questions.

Owing to the inability of the head of the motive power department of a great railroad to frequently visit outlying shops and terminals, this spirit is lost unless it is fostered by subordinate heads. The growth by combinations, etc., of railroad systems in the last few years has been so rapid that we have not had the time or opportunity of impressing this feeling on subordinates to the extent that it should be. Furthermore, in these expansions of railroads it is sometimes the case that the jurisdiction of subordinates is increased so as to cover too much territory, or in the case of foremen, they have too many men to handle to the best advantage. With the decreasing individual capacity of workmen, superintendence, supervision and instruction are more necessary than ever.

Suppose we have the big shop. It remains to get the best out of it, despite the possible drawbacks that have been named, and discover a policy, if possible, necessary for the success of these shops and the other big shops that are to come. As the big engines are handicapped by the small water cranes, small roundhouses and other small things, it is a possibility that the big shop is handled in a small way by a small man or, perhaps, by a big enough man, but tied down by small regulations and restrictions that do not permit him to do what could be done if he were more of a free agent. It is not well to give a small man a free hand, as he will make mistakes and is not equal to developing large things. The successful manufacturers have very competent men at the heads of their departments and they pay them salaries that railroad managements would deem extravagant for men having equal responsibility and the disbursement of, perhaps, greater amounts of pay-roll. The railroads must realize that for superior service, they must meet the salaries paid by the manufacturers. They have lost many a good man, who, while greatly desiring to remain in railroad service, could not afford to do so in view of the inducements offered by the manufacturers. The railroads get more of what may be called professional service, not only in the motive power department—work of men who have to fit themselves by long training, by study and earnest effort—for less money than almost any other line of business.

For a successful shop manager, the man must not only have practical and technical knowledge and experience, but must have tact and a knowledge of men and affairs, dignity, yet with all a familiarity that will make the humblest employee feel that he has a friend, yet one that he must respect.

The complicated labor problems of to-day will not be less complex in the future. The proper labor equipment is so vital a factor in the successful operation of shops or business that the small man, or even the large man who has but limited opportunities, may fail in handling that feature in management.

The larger shops also present an opportunity for manufacturing on a very profitable basis the repair parts for storehouse stock and subsequent shipment to outside points. The extent to which this may be done is almost entirely limited by the machine facilities of the shops, such extra work demanding extra machinery. The output of the shops in engines should not be affected one way or the other by the manufacturing, which should be separately accounted for and properly credited. Many large shops do a great deal of work outside of the requirements for repairs of engines which they actually have on hand, and this, together with work for the other departments, such as bridge jobs, maintenance of pumping machinery, etc., form a very large portion of the output of many shops.

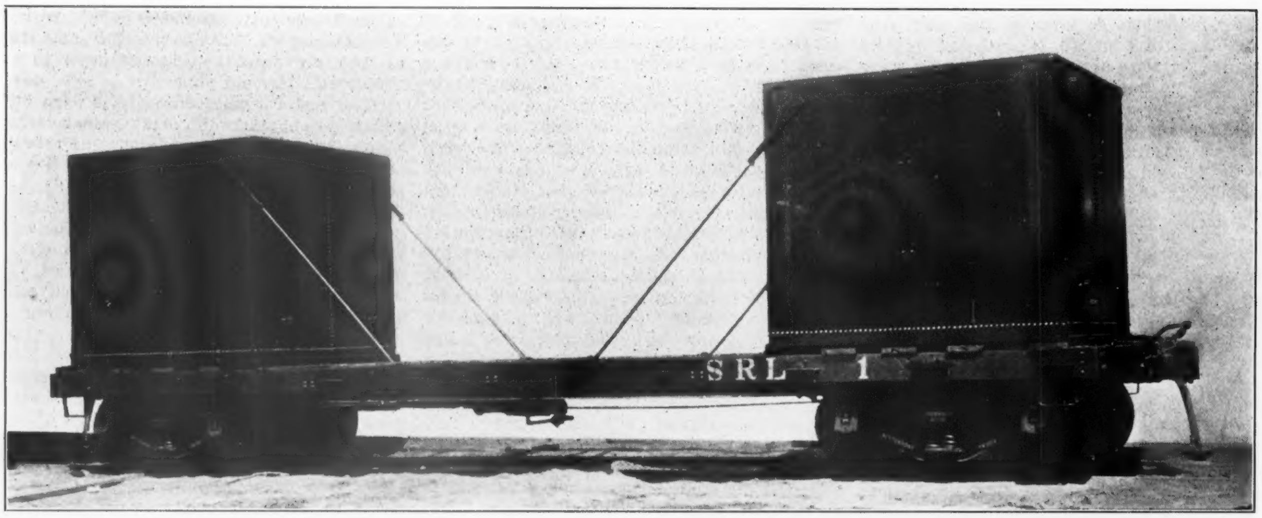
Manufacturing methods can also be extended to cover many of the regular shop operations, and by doing so this work can be reduced to a business basis, done on business methods.

Regarding the presentation of standard shop layouts, the committee has decided that it is best not to recommend any certain types. Instead an appendix to the report has been added in which are abstracts of the articles on that subject contributed recently to the *American Engineer and Railroad Journal* by Mr. R. H. Soule, originally chairman of this committee. The articles give complete descriptions and analyses of the important railroad shops of this country and include data covering smith shops, car shops, stores, roundhouses, etc., but for the purposes of this report, only those portions relating to erecting machine and boiler shops are included, and these have been revised sufficiently to bring them up to date by including all data possible to obtain relative to the latest shops built. This appendix is omitted here.

The report is signed by C. A. Seley, Chairman, and R. P. C. Sanderson. Mr. H. D. Taylor does not agree with certain conclusions in the report; therefore, his name is omitted.

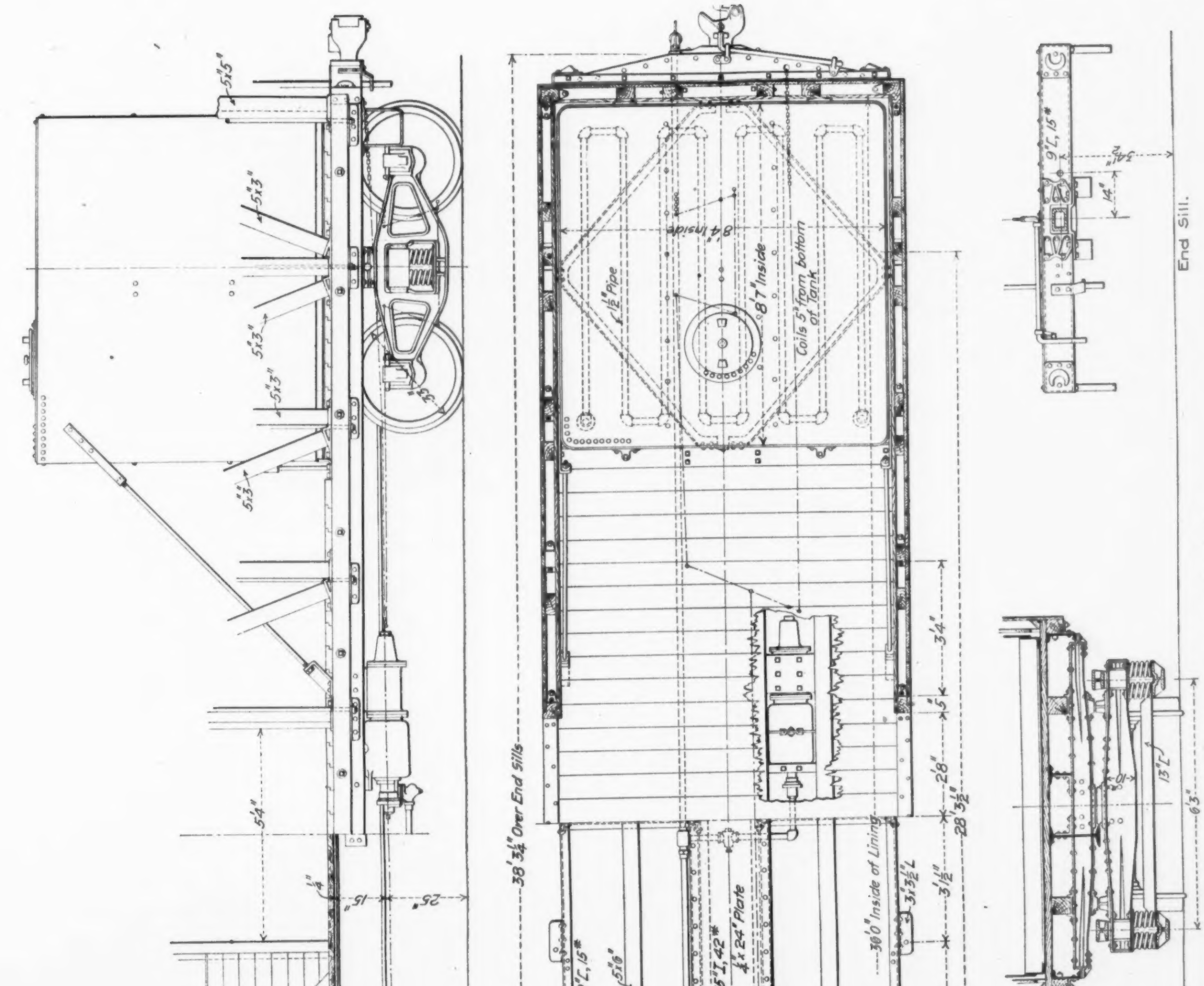
Combination Box and Tank Car.

Swift & Company have placed in service three combination 60,000-lbs. capacity box and tank cars for use in transcontinental traffic, illustrations of which are shown herewith. The use of this design of car, while providing tankage facilities in trips to the Pacific Coast, will not only avoid the mileage cost of the return trip charged for empty tank cars, but on the other hand will yield a revenue from utilization of the loading space between tanks. The exterior appearance of the finished car is no different from the ordinary box car. The wooden superstructure was applied by Swift & Company and the remainder of the car was designed and built by the Bettendorf Axle Company, Davenport, Iowa. The photograph shows the car before the wooden superstructure was applied.



Combination Box and Tank Car before Body Was Applied.

The underframe is the same as for Bettendorf tank cars, except that instead of the diaphragms for supporting the tank, 5-in. channel spreaders, three on each side be-



Plan, Elevation and Sections of Combination Box and Tank Car.

tween bolsters, are placed between the center and side sills for carrying the floor timber nailing strips. The center sills are 15-in., 42-lb. I-beams, and the side sills 9-in., 15-lb. channels. A ¼-in. x 24-in. cover plate runs the length of the car on top of the center sills. The end sill is also a 9-in., 15-lb. channel, of arch form, secured to the ends of the longitudinal sills, the center sills being 6 in. longer at each end than the side sills. A ¼-in. plate riveted to the top of the end sill runs back to a 3-in. x 3-in. angle riveted across the tops of the sills, to which the end sheathing is attached.

The body bolster passes through openings in the center sill webs and is secured thereto by 6-in. x 6-in. angles riveted to the top of the bolster and the inner sides of the sill webs. Diagonal braces made from ¾-in. x 10-in. plates pressed to channel form, extend from the corners of the underframe to the body bolster just outside of the center sills.

Each tank has a capacity of 2,400 gals. and is 8 ft. 7 in. long, 8 ft. 5½ in. wide, and 7 ft. 5 in. high inside. The bottom sheet is ⅜ in. thick and the remainder of the shell ¼ in. It is braced internally by two sets of 2½-in. angles riveted at the middle points of the tank sides, the braces taking the form of an inscribed rectangle, as shown in the plan view. A heater coil of 1½-in. pipe is placed 5 in. from the bottom of each tank.

The tank is held down by two bolts on each end passing through brackets riveted to the tank end sheet 18 in. from the bottom. The bolts at the end of the car pass through the end sill and those at the inner end of the tank through the wooden nailing strips. The tank is further held rigid by diagonal rods at the inner end, which are secured to the tank sides and to the side sills of the car, and by two 6-in. x 4-in. x ½-in. angles, one at each end, riveted to the car sills. Each tank is filled through a trap in the roof of the car and is emptied through a tank valve at the bottom. The latter passes through the center sill cover plate, and a large oblong opening 28 in. long is provided so that should the tank become loosened and move back and forth the valve will not be knocked off and the contents lost. The space between tanks is 20 ft.

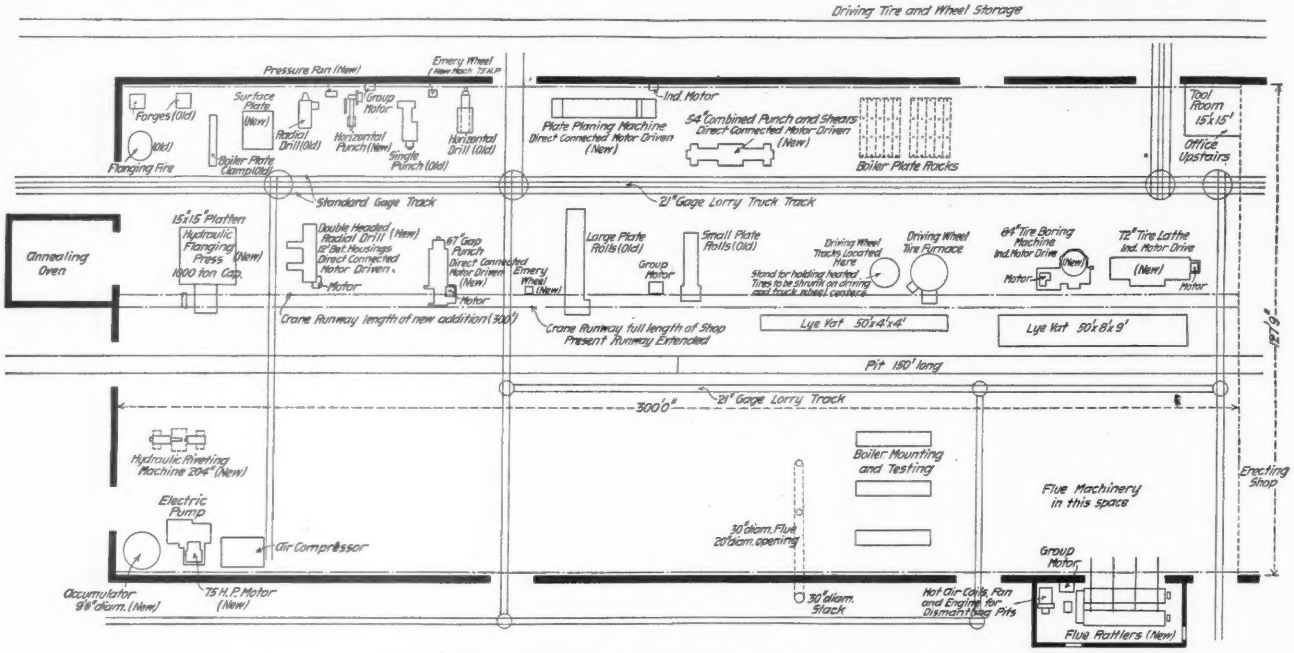
The car is mounted on Bettendorf standard 60,000-lb. cast-steel trucks, and is equipped with Miner friction draft gear.

The Mount Clare Boiler Shop of the B. & O.

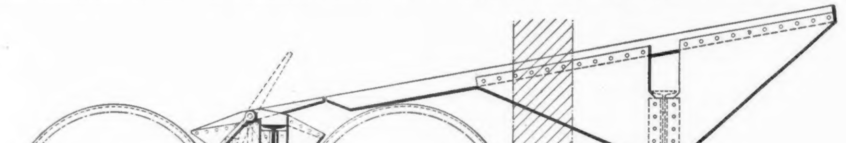
The Baltimore & Ohio built last year at its Mount Clare (Baltimore) shops a boiler shop that is notable in many respects. It was built as an extension to the locomotive erecting and machine shop and the crane runway over the erecting floor of the latter extended into it, making it possible to carry a boiler from the shop directly into the erecting shop without transfer. The erecting floor in the boiler shop is large enough for an output of 18 to 22 fire-boxes a month, and the machine tool section has machinery and facilities to do the machine work for this number of fire-boxes, and in addition, keep up the boiler running repair work done in the locomotive repair shop.

The erecting section of the boiler shop is served by a 50-ton crane of 69 ft. span, which can lift maximum loads at a speed of 10 ft. a minute. The crane has a 10-ton auxiliary hoist with a speed of 30 f.p.m. under full load; the speed of the bridge is 175 f.p.m. and of the trolley, 125 f.p.m. Also, when necessary the two 50-ton cranes of the locomotive shop can be used in conjunction with this crane. They likewise have 10-ton auxiliary hoists. The heavy machine tool section of the boiler shop is served by a 10-ton, single-trolley crane with a span of 54 ft., a hoisting speed of 27 f.p.m., and a crane and trolley speed of 200 f.p.m. The runway of this crane is 27 ft. above the floor, making it possible to group the machine tools and have the belts of sufficient length to avoid undue friction from tightness and yet clear the crane and operating cage.

The roof truss design is similar to that of the erecting and machine shop, but the lighting is much better, due to an additional skylight and larger windows. This was necessitated by the greater width of the building, which is 127 ft. 4 in. inside. The length of the shop is 300 ft. All of it is not used for boiler work, however, facilities having been provided on the main entrance track for dismantling locomotives in order to minimize the amount of handling of boilers, the procedure being as follows: The



Location of Machine Tools in New Boiler Shop.

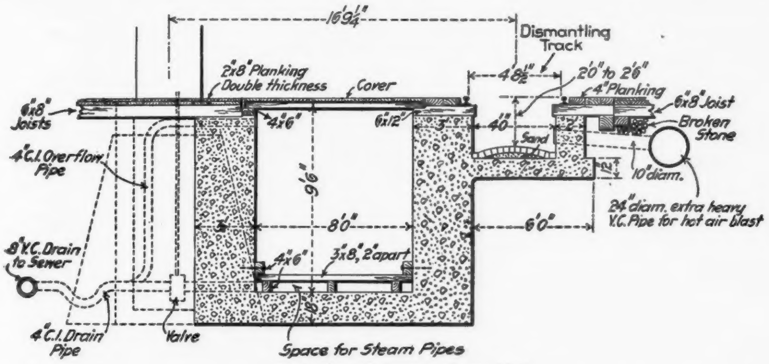


Flue Rattlers—Mt. Clare Shops B. & O. R. R.

locomotive is brought into the boiler shop and dismantled, the boiler being retained in the boiler shop until the repair work is completed, all mountings fitted up and the boiler tested on one of the three testing pits shown, after which it is carried into the erecting shop, assembled with the running gear and fitted up, leaving the shop, when completed, at the end opposite to the boiler shop.

The riveting tower at the east end of the shop serves a 17-ft. hydraulic riveter of special construction, built to handle a varied class of work, it being possible to equalize the pressure to 50, 75, 100, 125 and 150 tons. The riveting tower contains a 25-ton single-trolley crane, having a span of 31 ft. 6 in. The crane runway extends entirely across the bay in order to permit the crane in the erecting section to pass beneath the riveting tower crane, the runway of the latter being 52 ft. above the floor. The crane has a lifting speed of only 5 f.p.m., with the controller so stepped and the resistance so arranged as to give an absolute graded movement necessary for heavy and accurate riveting work. The speed of the trolley and bridge is 75 f.p.m.

The shop is electrically driven throughout. The power comes from the Camden power plant of the road, the surplus above what is needed for the electric locomotives in the Baltimore tunnel being largely used at Mt. Clare shops. It is a 500-volt, direct-current plant, and as the distance to the shops is about a mile and a quarter, the loss is not objectionably great.



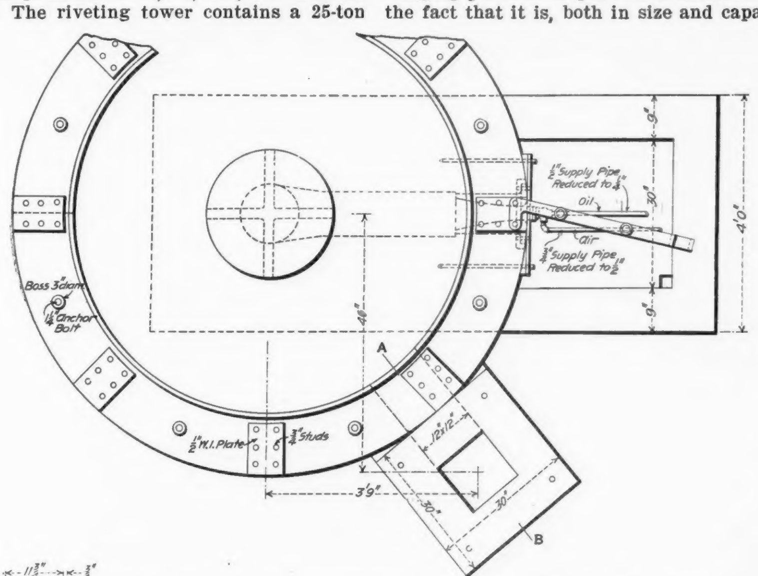
Details of Large Lye Vat.

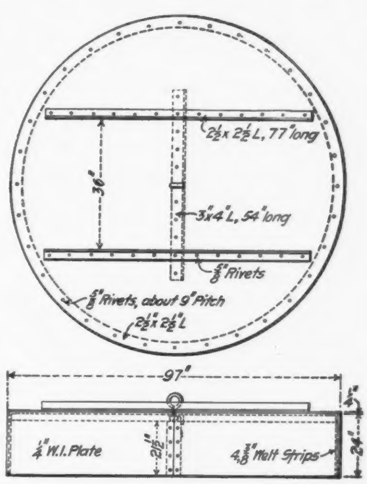
Of the heavy machinery, the hydraulic flanging press is of particular interest from the fact that it is, both in size and capacity, probably the largest in use by any railroad in the country, the size of the platen being 12 ft. by 12 ft. in the clear, and the press having a concentrated energy of 1,000 tons. This flanging press is equipped with a main ram in the top platen, four jack rams and one vise ram, the idea being to provide a press which would have a range of work sufficient to permit its being used continuously, in order that the investment—about $21,000—would pay interest. This press was described and illustrated in the *Railroad Gazette* April 22, 1904. Both the press and the hydraulic riveter are supplied with power from an electrically-driven pump at a pressure of 1,500 lbs. per sq. in. The pump and accumulator are under the riveting tower, but do not interfere with the free movement of the 50-ton crane.

In the end of the shop towards the locomotive erecting shop are two lye vats having a cross-section of 4 ft. 6 in. by 4 ft. in one instance, and 9 ft. 6 in. by 8 ft. in the other, and a length of 50 ft. each. Each of these vats has a movable floor, under which is located the necessary steam pipes to keep the solution at a high temperature. These floors can be taken up readily and the vats flushed directly into the sewer when the accumulation of grease and dirt makes it necessary. The vats are between the incoming dismantling tracks and the center supporting columns, and are covered with a movable floor, made in sections and fitted with rings so that they may be removed and handled by the overhead crane.

For a distance of 150 ft. the incoming locomotive track is provided with a pit 2 ft. deep, the rails being supported on 6 in. x 12 in. x 3 ft. timbers placed close together and extending far enough into the pit to permit a jack to be used on the inside, which construction has been adopted by the B. & O. as standard for roundhouses.

In addition to the machine tools which were in use in the old boiler shop, the following were installed: Motor-driven double angle shear with capacity to shear angles





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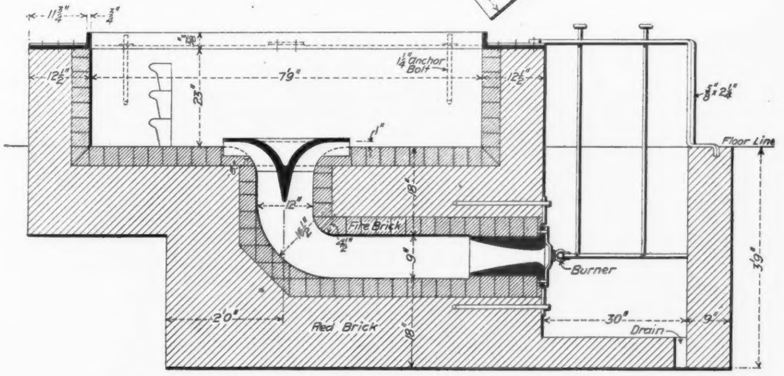
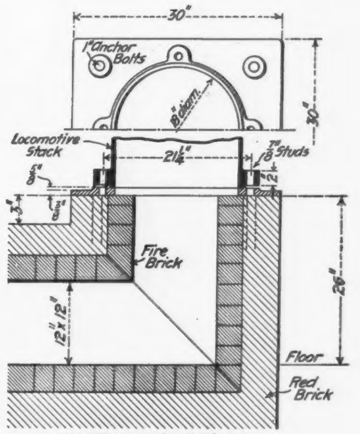




Section A-B at Stack.

Oil Furnace for Heating Tires—Mt. Clare Shops, B. & O. R. R.

6 in. x 6 in. x 1 in.; 67-in. gap punch with capacity to punch $1^{15}/_{16}$-in. holes in $1\frac{1}{4}$-in. plates; special motor-driven double-head radial drill for tube-sheet and mud-ring work, 12 ft. between uprights, and having each head adjustable in a longitudinal direction. The shop has a number of special tools and appliances, among which is the double-cylinder flue rattler shown in the drawings which is designed to permit an entire set of flues from a locomotive to be handled direct from lorry trucks to rattler, cleaned and placed on the rack entirely without manual labor.

In the machine tool section, the end towards the locomotive machine shop is devoted to wheel work, and contains among other tools an independent motor-driven tire-turning lathe of modern design, and a special oil furnace for heating tires, which is illustrated herewith. Also boiler plates are stored at this end of the shop. The plate storage is made of 4-in. pipe uprights imbedded in concrete and extended through the floor 4 ft., permitting boiler plates of different sizes and thicknesses to be handled by the 10-ton crane without moving any except the one desired, the plates being placed in the storage on edge.

The shop throughout is well equipped with air pipes. As the boiler shop is the most important user of air, and as the successful operation of pneumatic machinery of this character is dependent on a continuous high pressure, it was thought advisable to provide an independent air supply. An electrically-driven compressor with a capacity of 750 ft. of free air per minute was therefore installed.

The general arrangement of the machine tools and their relation to each other is shown in the ground plan. Each individual location was determined on only after careful consideration with a view to securing the most advantageous relationship of the tools from an operating standpoint, and to avoid as much as possible the rehandling or the reverse movement of any parts. The shop has been in operation for about nine months and has yielded the good results anticipated. The approximate total cost was about $300,000. The old boiler shop has been converted into a tender and steel car repair shop, being admirably adapted for this purpose. Among the new tools bought for this latter work were plate-straightening rolls 96 in. between housings, with a capacity to straighten $^5/_{16}$-in. steel.

Gasolene-Electric Motor Car for the Chicago & Alton.

The interurban service established by the Chicago & Alton on parts of its Chicago-St. Louis line to compete with the electric lines in contiguous territory was noted in these columns April 21st. It was stated that a small locomotive and coach was being used, but that it was the intention to build a gasolene-electric car for this and branch line service. The first, or experimental car, is now being built, and it is expected to have it ready for service about August 1st.

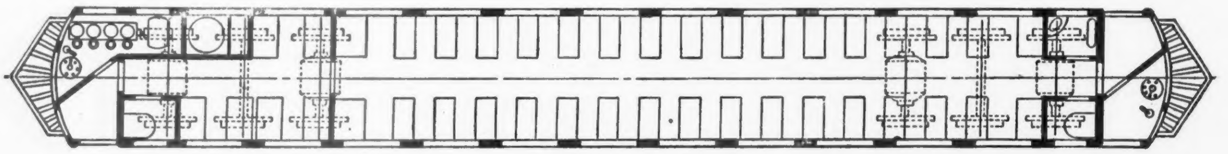


Fig. 1—Floor Plan of Chicago & Alton Motor Car.

A plan of the car is shown in Fig. 1. It will be converted from an Alton standard day coach 78 ft. long over all and weighing 100,000 lbs. The equipment will bring the weight up to approximately 115,000 lbs. The seating capacity will be 84 persons.

Being gasolene-electric, the power plant is, of course, made up of four principal elements, viz., engine, generator, storage battery and motor. A special design of gasolene engine has been devised, drawings for which are shown herewith. It is a two-cycle, air-cooled type, the endeavor being to produce the simplest possible design consistent with efficiency, in order to minimize the possibility of derangement in service. The admission and exhaust ports are shown at A and B respectively, and the port admitting air to the crank case, at D. The cross-section (Fig. 2) shows a section through the carburetor, which likewise is made as simple as possible. K is a sliding sleeve positively moved by the governor and H is wicking saturated with gasolene. Saturated air is therefore admitted through L and non-saturated through P, the volume of the respective openings determining the degree of saturation of the charge. In the drawing the sleeve is in the extreme upward position, with L closed. This carburetor can be used either with gasolene, kerosene or alcohol.

The igniter is at R, Figs. 2 and 3. It combines the make-and-break with the high-tension or jump-spark system, each of which has advantages over the other under certain conditions and with certain mixtures. A result of the combination of the two is to produce two sparks successively, one from each system. Patents have been asked on the device so that its details cannot at present be described. The entire device, including the magnetically actuated make-and-break and the coils for the high-tension system are contained in the casing R, which is easily removable. The governor controls the spark advance as well as the degree of saturation of the cylinder charge. Both features are therefore regulated by the speed of the engine, which in turn is positively controlled by the storage battery pressure or charge—that is, by the load on the engine.

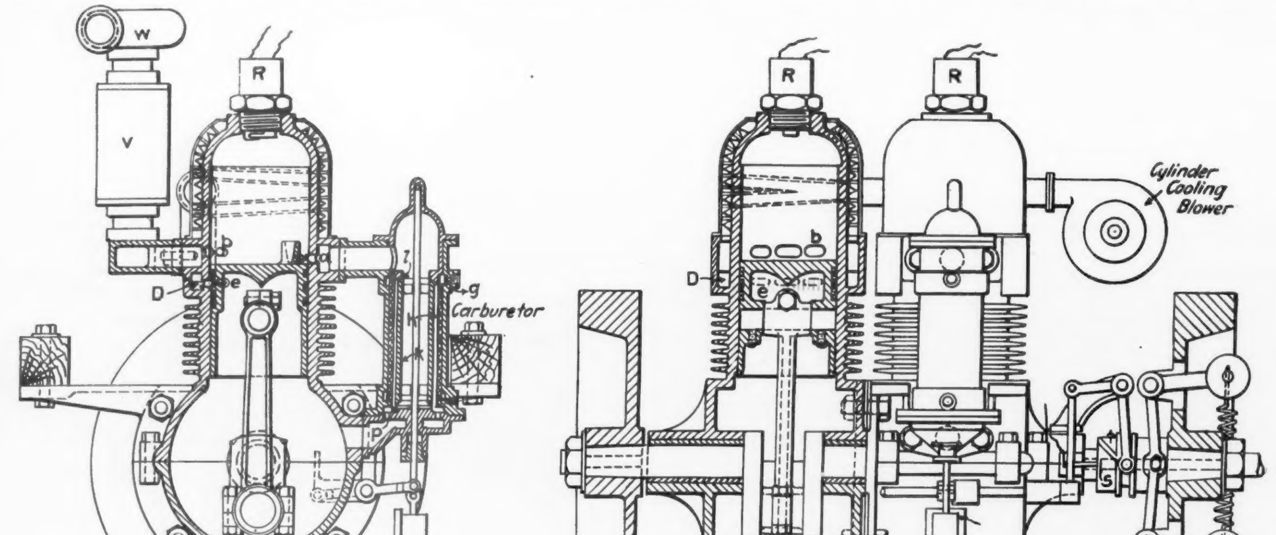


Fig. 2—Cross-Sections through Gasolene Engine.

The engine exhausts through a muffler shown at V, having a centrifugal blower, W, to remove its contents; the effect being to cause the engine to exhaust into a partial vacuum, eliminating back pressure. Additional advantage accrues from the effective scavenging resulting, insuring a purer combustible charge in the cylinder.

A novel method of air cooling is employed. The cylinder has ribs running around its exterior to form spiral channels, the whole being enclosed in a sheet-iron jacket. A blower, which in larger units is direct connected to the engine shaft, forces air through

these channels, the arrangement being to have the coolest air strike the hottest part of the cylinder. The air circulates completely around the cylinder, and its pressure and therefore its cooling effect is regulated by variations in the blower speed.

The engine will have four cylinders, with a nominal horse-power of 120, and will weigh not to exceed 1,200 lbs., or 10 lbs. per horse-power. It will be direct connected to a 75-k.w. shunt-wound generator giving 250 volts at 750 r.p.m. There will be four 50-h.p. street railway motors mounted directly on the axles, the operation of the car being by standard street car controllers. The maximum speed will be 35 m.p.h. on level track.

The storage battery will consist of 110 Morrison cells carried beneath the body. The car is driven entirely from this battery, the generating plant being used only to charge the battery. Automatic devices provide for cutting out the generating plant when the battery is fully charged, and starting it up again before the battery is entirely discharged. One switch between battery and generator will place the entire mechanism in circuit and therefore in operation. The plant is designed to be practically automatic, requiring neither constant nor skilful attention. For operation on the Alton a crew of not less than three men—a motorman, conductor and flagman—will be carried, as the cars will run in the regular train service.

A specially devised and patented momentum-storage air-brake system will be used. An air compressor is thrown into operation by means of a magnetic clutch in circuit with the "off" notch of the controller. A switch operated by reservoir pressure opens the circuit when the proper pressure has been attained. There is also provision for setting the compressor in operation while the car is running under current, should the main reservoir pressure fall too low.

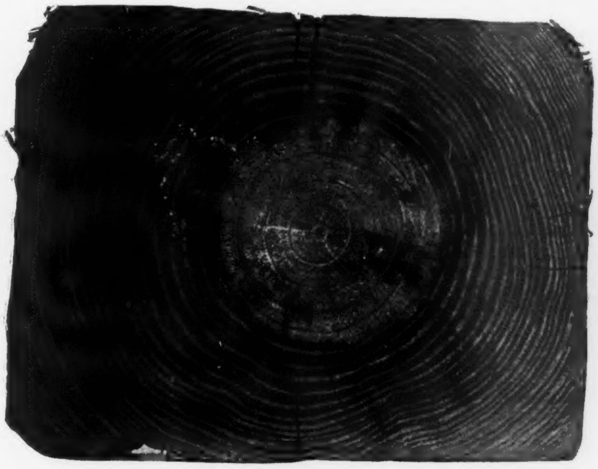
The car was designed and is being built by the Gas-Electric Motor Car Co., Chicago.

The Rueping Process for Preserving Timber.

The promising quality of the Rueping process for preserving timber is that with the use of much less antiseptic material an equally good result, and for some uses a better result can apparently be had. It requires less material because the wood tissues only are soaked or coated, while the wood cells are left unfilled. The process is a method of injecting any preservative, whether creosote, zinc creosote, zinc chloride, or other material. It is extremely simple. When the cylinder is filled with railroad ties, or other timber, air is pumped in to a pressure of 60 to 65 lbs. per square inch, and this pressure is maintained for an hour to an hour and a half, until the air cells are filled with the compressed air. The time needed for this result varies rather with the length of the timber than with its diameter. It is desirable, too, as in all preservative processes, that each cylinder's charge of timber should be as nearly as possible uniformly seasoned.

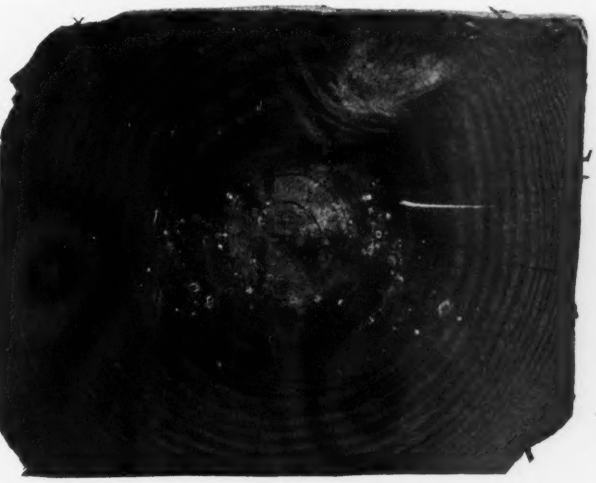
Without reducing the pressure in the cylinder, the warmed preservative fluid is then forced in at an increased pressure of about 40 lbs. per square inch. The result of this work is that minute bubbles of compressed air remain in the wood cells, or pores, and the fluid is forced into the wood fibre. When the pressure is released most of the free fluid is, by the expansion of the compressed air bubbles, forced out of the timber. A further amount is drawn from the wood by pumping out a partial vacuum.

The photographs shown here are from center sections of three loblolly pine ties and one long-leaf pine tie treated by the Rueping process, as above described, and are chosen from those having heart wood of different diameters in order to make plain the fact that this method impregnates all of the sap wood, whatever the size of the heart may be. In one section a knot appears and this resisted full impregnation, as it usually does. The rate of growth of the trees from which these ties were cut is interesting. The specimens show that under favorable circumstances loblolly pine trees grow to tie-size in something like 30 years, while long-leaf pine grows only one-third as fast. Also in loblolly pine the increase in diameter in the early years is often ten times that of later years.



Loblolly Pine.

Long Leaf Pine.



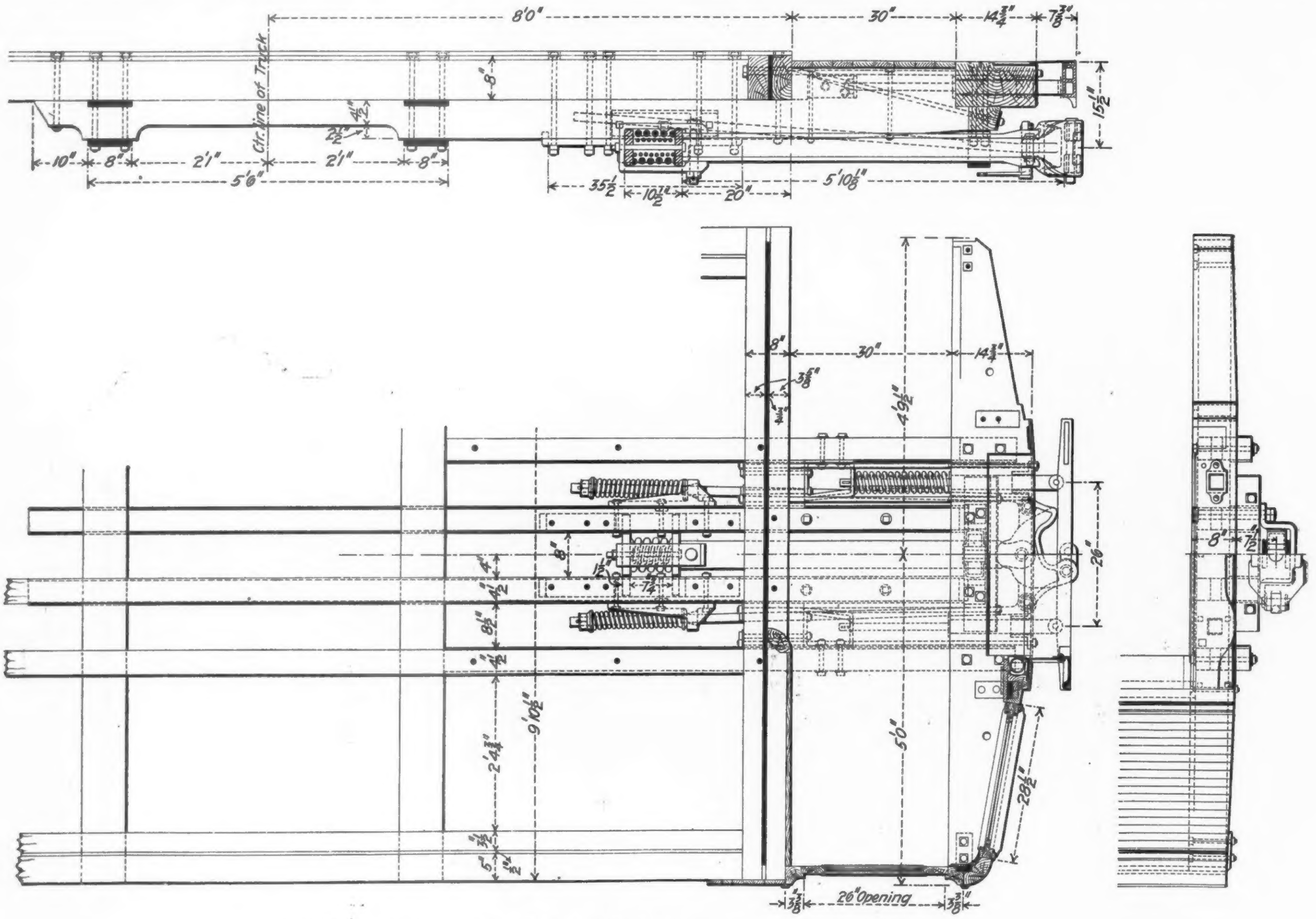
Loblolly Pine.

Loblolly Pine.

Messrs. C. Lembcke & Co., 80 Wall street, New York, furnish creosote obtained from Europe at 6¼ cents per gallon, to be used in the Rueping process. They say that the total cost, including interest and depreciation, of creosote treatment such as is shown in the photographs (7 in. x 9 in. x 8 ft.) is 20 cents per tie.

Platform for Wide Vestibule Cars on the Big Four.

Ever since the introduction of the Miller platform and the demonstration of what it would sustain in the case of accident, it has been an axiom of car construction that the platform should have the strength to sustain not only the ordinary buffing stresses but the extraordinary blows imposed upon it in collision without either buckling or collapse. Unfortunately this axiom has not always been followed in practice, and results have been correspondingly unsatisfactory.

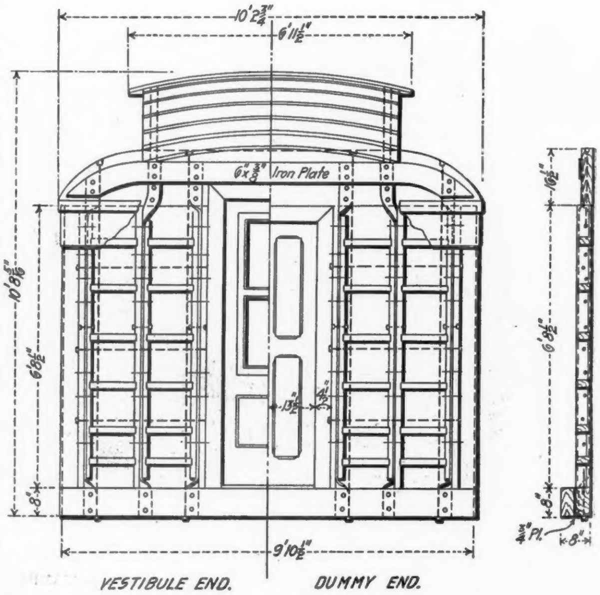


Details of Platform for Wide Vestibule Passenger Cars—Big Four.

The value of this strong construction is realized, and has often been demonstrated on the Big Four where great pains are taken to have the platform as strong as the car, and to be able to withstand almost unlimited punishment without being disabled. The accompanying illustration shows the construction that is used on the vestibuled passenger cars of the road. In the first place, the end sill is strengthened by the use of a flitch plate ¾ in. thick, and extending the full depth (8 in.) of the sill, while the roof is stiffened by a carline of 6 in. by ⅜ in. iron. These two are connected at the corners by a plate that is given a quarter turn at each end so that it presents its full strength to any stress coming from the end of the car. The corners of the vestibule are stiffened in a manner that is equally substantial. As will be seen from the plan, there is a 3 in. by ¾ in. plate laid into the corner post, and one of the same width, but 1 in. thick at each side of the opening; the latter, however, presenting its broad face to the end of the car.

The longitudinal section and plan of the platform shows the arrangement of the timbers. It will be seen from the former that the platform sills coincide with the center and two intermediate sills of the car, and extend well back of the inside body bolster on cars intended for use on six-wheeled trucks. These timbers are securely bolted to the car sills over their whole length. Outside the end sills, the platform timbers carry a supplementary piece that serves to transmit all buffing stresses directly to the sills so that there is no tendency for the platform to buckle either up or down.

The draft rigging is placed beneath the platform in the usual position, and is of the three-stem type, as shown. The underframing of the car itself is stiffened by the use of plates laid between the two timber portions of the side sills after the manner of a flitch plate, while corresponding plates are bolted to the sides of the center and intermediate sills as shown on the plan.

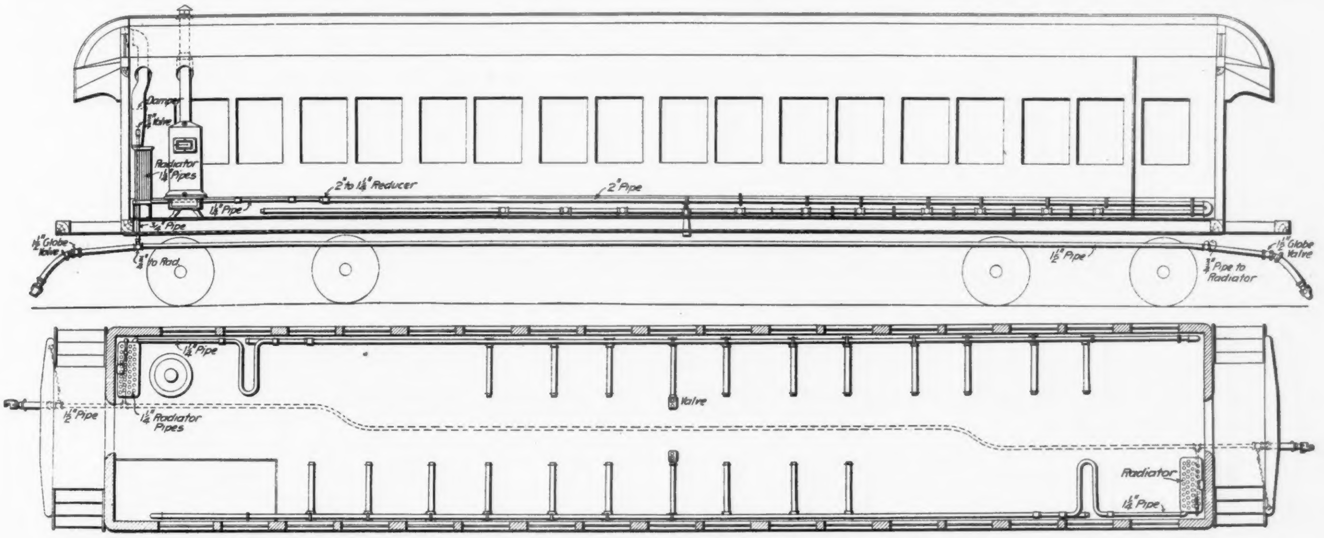


Standard End Framing for Passenger Cars—Big Four.

As the proof of the pudding is in the eating, so the strength of a drawgear may be said to be proven by its behavior under exceptional conditions. It is under such conditions that this construction has shown its worth. A few weeks ago a train running at a high rate of speed ran into an open switch and collided with cars on a siding. The locomotive was derailed and rolled down a bank, the forward cars of the train were rolled over, and all of the remainder were more or less injured, but there was not a platform on any car of the train that was sprung out of alinement in the slightest. Every platform was as true and straight when the cars were examined as when they were first turned out of the shop. There was apparently not the slightest tendency to telescope, with the result that, though the accident had all the makings of a disaster, not a passenger was injured in any way; thus adding one more argument for those who advocate a strong platform, regardless of its type, for passenger cars.

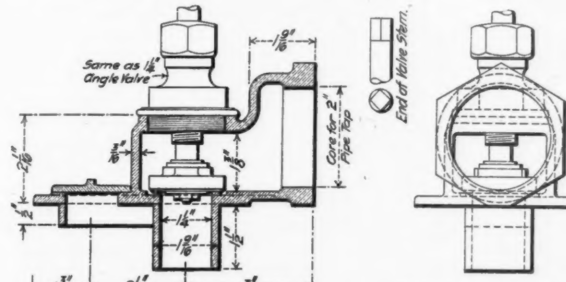
Heating and Ventilating Passenger Cars on the North-Western.

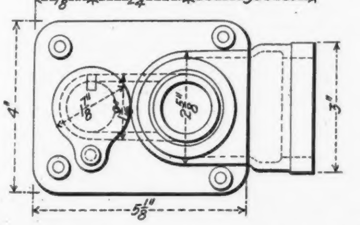
The accompanying illustrations show the steam heating and ventilating system used on the passenger equipment of the Chicago & North-Western. The main steam train pipe is placed under the car in the usual way and connections between cars are made with standard steam hose and Gold couplings. The train pipe valve at each end of



General Plan of Heating System for Passenger Cars—Chicago & North-Western.

the train is, in some cases, a plain globe valve, and in other cases it is furnished by the New York Heating & Lighting Company, in which case a handle extends out to the side of the step so that the valve may be opened or closed without going between the cars. The highest point in the 1½-in. train pipe is in the center of the car, and the water of condensation drains in both directions to the ends of the car when the steam is cut off from the engine. A tee is fitted in the train pipe just inside the end sills at each end of the car for extending a ¾-in. pipe to the heating system inside of the car.

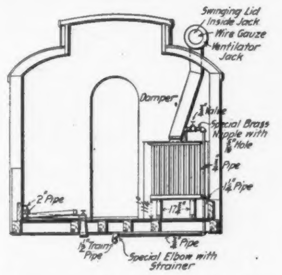




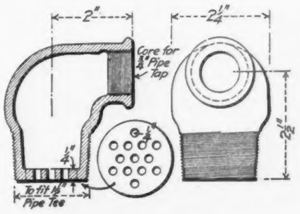
Outlet Floor Valve.

The details of the elbow used on this tee are shown in the accompanying illustration. The portion of the elbow extending into the tee has its end cast solid and a series of holes are drilled in it so that it will act as a strainer to prevent cinders and pieces of hose tubing from getting into the pipe and entering the heater system and clogging up the valves. This branch to the tee is always put to the top side of the pipe so that any foreign matter which adheres to the elbow above the radiator which is inside of the car pipe leads from the train pipe to a point and thus keep the ports clean. The supply will drop down, when the steam is cut off, near the door. The nipple between the valve and elbow varies in length from 1½ in. to 2½ in. and has a $\frac{5}{16}$-in port opening through which steam is admitted to the heating system.

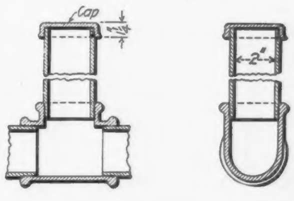
The heating system is composed of two



Cross-Section through Car.



Inlet Elbow with Strainer.



Detail of Seat Tees.

parts, one on each side of the car, and each part is controlled independently of the other. Steam is admitted into the radiator through a Jenkins disc-seat globe valve. The radiator has approximately 50 sq. ft. of radiating surface. It is placed near the end door inside of the car and when the door is opened the cold air rushes in and forces the hot air towards the center of the car; thus the hot and cold air are mixed and the cold air is heated very quickly.

The base of the radiator is cast in one piece, with a port on each side of it. The steam is admitted into the port at the end of the base and is discharged at the same end, but out of the opposite port and into a 2-in. pipe which extends to the opposite end of the car and returns to branches underneath the seats. These branches are 2½ ft. long and are set at a slight angle to permit the water of condensation to drain back into the main pipe. The floor valve is in the center of the car at the lowest point in the heating system and all the water of condensation flows to this point by gravity. In some cases a dead line is extended from the floor valve toward the radiator and this in time becomes heated its entire length. The details of the floor valve are shown in the illustration. The opening in the valve is large enough to prevent its freezing up and no traps are used. The valve is fitted with a slide plate in the floor which enables the trainmen to see underneath the bottom of the car and determine how much water is being discharged. The principle of the system is to collect the water of condensation and carry it in the car until it has lost its heat; then discharge it and allow the heater pipes to fill up again; hence it is necessary to leave the valves normally closed, occasionally opening them and allowing them to drain. The floor valve is closed while the train is standing in a station, so that the water of condensation will not be discharged on the station platforms. If the weather is very cold the valve is unseated and the water is allowed to drip in such quantity as, in the judgment of the trainmen, is necessary to keep sufficient live steam entering the radiator. The amount of heat in the car is also controlled by the valve on the top of each radiator, the nipple having a $\frac{5}{16}$-in. opening and admitting such quantities of steam as are necessary to maintain a comfortable temperature. The port in this nipple is of such size as to practically form a header of the train pipe. The inlets on an 8 or 10 car train are made equal to the train pipe area. With this size of nipple a higher pressure can be obtained at the rear end of the train than is possible when the old style of port opening is used through a ¾-in. pipe, in which case most of the pres-

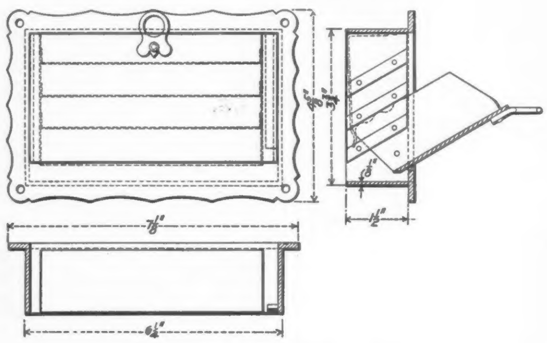
sure is taken by the cars at the front of the train. All portions of this heating system are inside of the car, and thus the danger of freezing is reduced to the minimum.

The ventilating system consists of a jack on the outside of the car connected by a pipe to the radiator. The air rushes into the jack and is forced through the pipe into the body of the radiator and is discharged along the floor of the car. In winter the air coming through the jack is heated as it passes between the radiator pipes. In summer the ventilating apparatus works in the same way, except that the air is not heated.

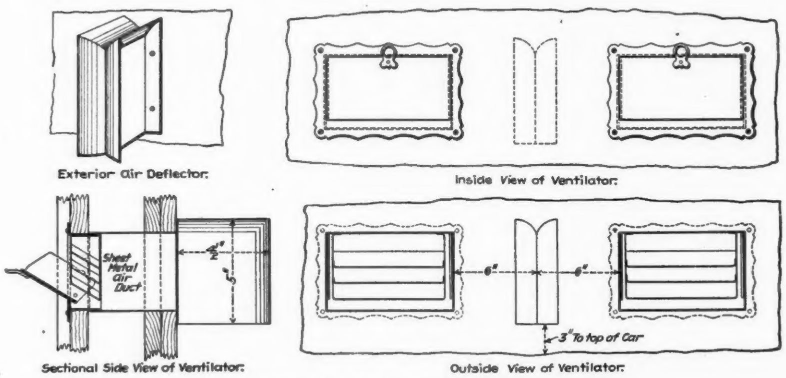
C. A. Schroyer, Superintendent Car Department of the Chicago & North-Western, to whom we are indebted for the above information and drawings, states that a perceptible difference is noticeable between the odor and atmosphere of cars equipped with this system of ventilation and cars which are provided with only the deck sash ventilator. This device is cheap to apply, standard fittings being used, and it is claimed that it is simple and efficient of operation.

An Automatic Ventilator for Passenger Cars.

The accompanying illustrations show an automatic ventilator made by the Automatic Ventilator Company, New York. The device, as shown, is placed in the deck sash of the car and consists of an exterior and interior deflector. The exterior deflector is placed between two openings in the deck sash and the interior deflectors are placed in the openings. When the train is under way the air strikes the front sides of the exterior deflector or double wing and is forced into the car through the forward interior deflector, at a rate in proportion to the speed at which the train is moving. All substances of weight, such as cinders, etc., fall to the deck of the car on striking the exterior deflector, and the smoke, steam and gases arise; thus nothing but pure air is injected into the car. On passing through the forward opening the air is broken up by the interior deflector and is directed to the top of the car. From here it gradually descends and mixes with and is heated by the air in the car. The foul air is sucked out of the car by means of a vacuum which is produced at the back of the exterior deflector while the train is in motion; thus the exterior and interior deflectors, arranged as shown, produce a continuous current of air in the car. The inflow of air is steady and continuous, and even in zero weather it is claimed that pure air containing 20 per cent. of oxygen injected at the top of the car where the highest temperature prevails does not lower the temperature in the car. Six railroads have adopted this device as their standard system of ventilation, and upwards of 30 roads are experimenting with it. This device is cheaply and easily applied and has proved efficient in operation.



Details of Automatic Ventilator.



Automatic Ventilator as Applied to Passenger Cars.

The Manufacture of Chilled Wheels.

BY P. H. GRIFFIN.

The rapid increase in the weight and capacity of car and locomotive equipment has caused a like increase in service requirements of car wheels, and has developed some new causes of failure and intensified those that existed before. As the chilled wheel is used almost exclusively under freight cars the possibility of improving the strength and wearing capacity of such wheels is one of the most important matters to be considered by railroad officers at the present time. It is important, therefore, to know what the possibilities are for improvement in chilled wheels as now manufactured and used, and what the cost of such improvement will be.

The failures of chilled wheels that have occurred are largely due to the use of wheels made from inferior material or under improper conditions of manufacture. Wheels of light section may have been used, or the design may have been incorrect. The price paid may have prohibited the use of proper material and methods of manufacture, or the construction of equipment may have caused heavy strains on wheels as in the case of rigid side bearings and the flange strain caused thereby.

The most important detail in the manufacture of good wheels is quality of material. The chilled wheel owes its origin to the peculiar high chilling property of iron smelted with charcoal in the blast furnace, which property is not possessed by iron smelted with coke. This property causes charcoal iron when cast against a chill to become intensely hard on the surface, while the remainder of the same casting, not in contact with the chill, consists of strong gray metal which blends into the chilled surface, forming an inseparable mass. There are many grades or brands of charcoal iron possessing this property in greater or less degree, and in years gone by discussion as to the best grades for use in chilled wheels was quite common. Salisbury and other brands of charcoal iron made in New England took the lead. Southern charcoal irons were largely used, also Lake Superior charcoal iron which is produced in large quantities, and possesses high chilling as well as other good qualities. At the works of all reputable wheel makers could be found an assortment of such irons, and many leading railroads specified some particular brand or mixture of brands. Of late years the use of non-charcoal irons and scrap has become quite general, and many chilled wheels have been put in service which have contained large percentages of such material. The use of steel scrap to harden, and ferro manganese to toughen and give chilling properties, has established the use of such non-chilling irons, but the quality of chilled wheels has not been improved by such practice. The indiscriminate delivery of scrap wheels in part payment for new wheels, and the consequent use of such scrap in making new wheels has gradually distributed the non-charcoal iron wheels throughout all wheels, and thus spread the undesirable metal in all directions. It must be remembered that every chilled wheel made is destined to a sort of reincarnation, so that it will probably go on to the end of time bearing in each successive life the burden not only of its own defects, but of those acquired from its fellows in the foundry cupola. The manufacture of charcoal pig iron is one of the oldest industries in this country. It has increased from year to year, particularly in the Lake Superior region. The present annual capacity of all charcoal furnaces in America exceeds 500,000 tons. The supply is therefore ample so far as requirements for chilled car wheels are concerned.

The wheel made some years ago may have had its failings, but it certainly was made of better material than the average wheel of to-day, which is bound to progress toward a lower average quality of material, on account of the general practice of recasting old wheels into new ones, and the increasing use of non-chilling or non-charcoal iron and scrap. Railroads should buy, at least for special service, such as 50-ton car equipment, wheels made from new charcoal iron. It is not necessary to specify mixture or kinds of iron, but simply to provide for wheels of new charcoal iron. The additional cost will not be great. In the case of wheels bought at average prices the added cost should not be over eight to ten dollars per car.

Although the strength of wheels has been increased by the use of heavier sections, this only provides increased safety for the body of the wheels. The flange has remained practically the same as before because the section has not been increased. It has therefore been possible to secure increased flange strength only by increasing the strength of the material used. As flange failures in present wheel equipment are quite frequent, it follows that to eliminate the cause it is necessary to discontinue the use of material which has failed, in new wheels being made. Wheels made out of new charcoal iron could be plainly marked and would unquestionably bring a higher price as scrap. At any rate, the recasting of such wheels in making new wheels of similar quality could be allowed, and this would in due course bring their value approximately up to that of charcoal iron.

The design of wheel adopted by the joint committee of the wheel makers and the Master Car Builders' Association follows in general the average practice that has given satisfactory results in service. It would be well if the use of all 33-in. wheels under 600 lbs. in weight was discontinued. The difference in

cost of lighter wheels, where the additional value of heavier wheels as scrap is considered, is very small. On wheels weighing 560 and 600 lbs. the net additional cost of the latter (scrap value considered) is about 25 cents per wheel. The lighter wheels are liable to be put under heavy equipment, and in any case the frequent overloading of lighter cars creates conditions that call for wheels of not less than 600 lbs. weight.

The requirements of tests and specifications for wheels have been increased from year to year in proportion to the requirements of service. It is important to maintain the relation between conditions of test and of service, for if this is not done it compels wheel makers to make wheels with more reference to passing test conditions than to meeting service requirements. Besides it is not reasonable to hold makers to an order of practice set up by specifications and tests, and to also hold them to a guarantee of service requirements that may necessitate quite a different order of foundry practice. The thermal test as applied by some railroads illustrates this. When the band of hot metal has been applied, the tread of the wheel is rapidly heated while the plates a few inches away are practically cold; this throws the entire strain of expansion on the tread and flange, and compels makers to design wheels to withstand such conditions, although they are never found in service. Heating from brakes takes place more slowly and uniformly. Expansion strains from brake heating occur in a very different part of the wheel, viz., at the junction of the double plates. To make wheels, therefore, to stand a heavy thermal test, makers must, to a considerable extent, disregard service conditions and yet are held to the latter by guarantee conditions. The thermal test has its good points, but the present disposition to make it more severe is unwise.

The general conditions attending the manufacture and use of chilled wheels leave much to be desired if best results are to be obtained. If wheels are out of round, or out of balance, if not properly bored for axle seat and fitted to axles, proper results are not obtained. Specifications sometimes provide for conditions of manufacture to insure rotundity within certain limits, but matters of this kind are left almost entirely to makers. Too often a lack of care on the part of the makers results in the making of wheels that are not what they should be. The chills in which wheels are cast get out of round, with the result that every wheel made in such chills possesses a like defect. Wheels may be five to ten pounds out of balance, perhaps more, but this important detail is seldom looked after. The work of boring hubs and pressing on axles is generally done in railroad repair or car shops at a rapid rate, often on machines that have been in such long and constant use that true and proper work cannot be done on them. Wheels are pressed on axles at pressures that vary a great deal. Boring mills and wheel presses should be inspected and tested to ascertain if they are in good working order.

In many cases these things receive little attention, and the result is that wheels are often put in use when out of round, out of balance and improperly fitted to axles. These facts are generally known, but seem to be accepted as inevitable. This is not so at all. Not only can the chilled wheel be given mechanical finish of the highest order at moderate cost, but the work can be rapidly done, and the finish will be retained longer than in the case of any other type of railroad wheel.

To fit wheels properly for service care must be used to insure wheels being made in the foundry as close as possible to balance and rotundity. The former depends on the preparation and casting of molds, condition of chills, and shrinkage property of the mixture. With proper care and experience wheels can be cast that are true within $^{1}/_{16}$ in. to center, and within 5 lbs. of balance.

Wheels should be taken from molds and placed in annealing pits at the correct time, not too soon or too late. Pitting too soon causes liability to warp or bend; pitting too late induces shrinkage strains.

Wheels should be tested when removed from annealing pits to see if bending or warping has occurred.

Boring mills should be kept in good working order and should be of heavy modern construction so that accurate work can be rapidly done.

One cut should be bored out of every wheel at the shops of the makers to admit of further mechanical finish, and wheels should be ground true to center, either before or after placing on axles. The former is preferable on account of the fact that the great proportion of wheels are shipped unmounted and because railroads generally require a finishing cut to be taken to fit wheels to axles.

After they are ground true to center, wheels should be tested for balance and corrected for defects by the usual means.

Wheels should be taped for circumference and marked accordingly. Care should be used by railroads to put wheels of the same circumference on the same axle.

The above work can be supplemented by any special drop or thermal tests called for. As part of the foundry operations makers should use working tests, running continuously with the casting of wheels, which would plainly indicate the general quality of the metal as it is melted and cast. These tests should be carried out on a scale that will give full information as to the quality and condition of the metal at all times while the operation of casting is being carried on. By supplementing the information thus obtained with careful shop inspection of every wheel and tests of all defective wheels to indicate general quality, it is possible to maintain a shop practice that insures the quality of every wheel, besides establishing a standard of quality and representative tests that can prevent the delivery for service of any wheel of improper quality.

Just what it means in additional tractive power required to overcome the common mechanical defects of every wheel is not easy to determine, but it cannot be denied that for every fraction of an inch that wheels are out of round, or that wheels on the same axle vary in circumference, and for every pound that wheels are out of balance, additional power is required. A variation of ⅛ in. in diameter, or ⅜ in. in circumference would cause a wheel (if it could) to travel about 15 ft. ahead of the wheel on the opposite end of the axle in running one mile. The heavier the load, the more power is required to overcome this tendency. What actually happens is that the larger wheel runs as far ahead as the truck construction will allow, and stays there, straining all connecting parts and taking additional power.

The result of wheels running out of balance is a simple mechanical question and one that can be readily determined as to results. It involves the direct loss of power required to overcome it. No mechanical superintendent would allow any machinery to run at high speed with revolving parts weighing 600 lbs. or more out of balance to the extent of five or ten pounds.

It seems strange that railroad officers have not been more interested in the possibilities of overcoming these conditions. It is very likely that all the economies that can be obtained by the most careful use of coal, oil, etc., will not compare with what could be saved by the establishment of proper mechanical conditions in car wheels. All the problems necessary to bring about such conditions on any scale desired are already solved, and the use of mechanically perfect chilled wheels only awaits the willingness of the railroads to pay for them. For an additional cost of not to exceed $5 per car, wheels can be obtained which will be mechanically perfect in every respect. Let any one stand beside the track at a point where heavy freight trains pass at full speed, and note the amount of shock and strain on cars and track that is plainly attributable to the lack of proper mechanical conditions in wheels, and there will be little need of arguments to establish conviction.

It has been contended by some railroad men from time to time that it does not matter so much if wheels are not exactly round, or if they are out of balance, that grinding the treads removed valuable wearing material, and that the support of the wheels on the rails overcomes lack of balance. Such arguments are not mechanically correct and when followed in practice simply prevent progress toward better results. Heavier equipment, higher speeds, greater loads, all demand not only adequate increase in resistance to strain and shock, but also intensify the result of improper mechanical conditions.

The possibilities of the chilled wheel for meeting conditions of service that are likely to arise in the future, lie in two directions. First, increase of strength and resistance to wear in the material of which the wheels are made and improvements in type and section of wheel. Second, improvements in methods of manufacture.

The property of chilling possessed by charcoal pig iron of certain grades is due to the combination of the carbon and iron at point of contact with chill. This chilling of the hot metal causes the sudden lowering of temperature and results in the formation of a crystalline structure on the chilled face. The crystals stand at right angles to the surface of the chill, and have distinctive characteristics, according to the presence or absence of certain constituents in the iron. These crystals of white iron may be of fine needle appearance with strong adhesion to each other, or they may be of coarse granular appearance, readily separating or cleaving from each other. The former are naturally of the best quality for good chilled work. There is also a difference in the hardness of chilled iron, some being soft enough to be readily cut with a drill or file, while other qualities have a hard surface that resists any tool. In car wheels the chilled surface has to sustain many severe conditions, one of which is the friction caused by the sliding of the wheel on the rail when a severe application of brakes prevents revolution. This sliding induces intense heat, burns the iron at the point of contact and renders it liable to shell or crumble out later on when the constant revolution of wheel causes it to strike a blow on the rail each time the flat spot comes in contact. If wheels were properly fitted for service and brakes are adjusted so as to equalize the braking force in all cars, instead of having it excessive on a few, wheel sliding would be less frequent. Aside from causes attributable to the use of brakes, the actual wear of chilled iron in car wheels is very slight. A good chilled wheel will remain in service for four or five years with less than ½ in. of wear on the tread. The remarkable hardness and wearing quality of chilled iron can be judged from this fact.

The service obtained from chilled wheels under present conditions is far below what

it would be if proper conditions were established and maintained by railroads. The fact that the cost of such wheels is so low, and that makers give such broad service guarantees, naturally leads to the practice of placing wheels in service with the least possible cost of preparation, and their removal and replacement with new wheels without much attention to practice which would lengthen their life.

The principal factors of value in charcoal iron for chilled wheel manufacture are strength in general, and hardness combined with wearing quality in the chilled surface obtained. By the use of special alloys some remarkable qualities of chilled iron have been produced. In the course of some recent experiments made by the writer, chilled metal was produced in which the crystalline structure was composed of what are known as hair crystals. These crystals have no angles but interweave with and radiate from each other in a complex but perfectly ordered arrangement. The strength of this chilled metal is equal to that of the best crucible steel, and the increased strength is due to the process of chilling. This reverses the ordinary result when chilling occurs, which is that brittleness is increased.

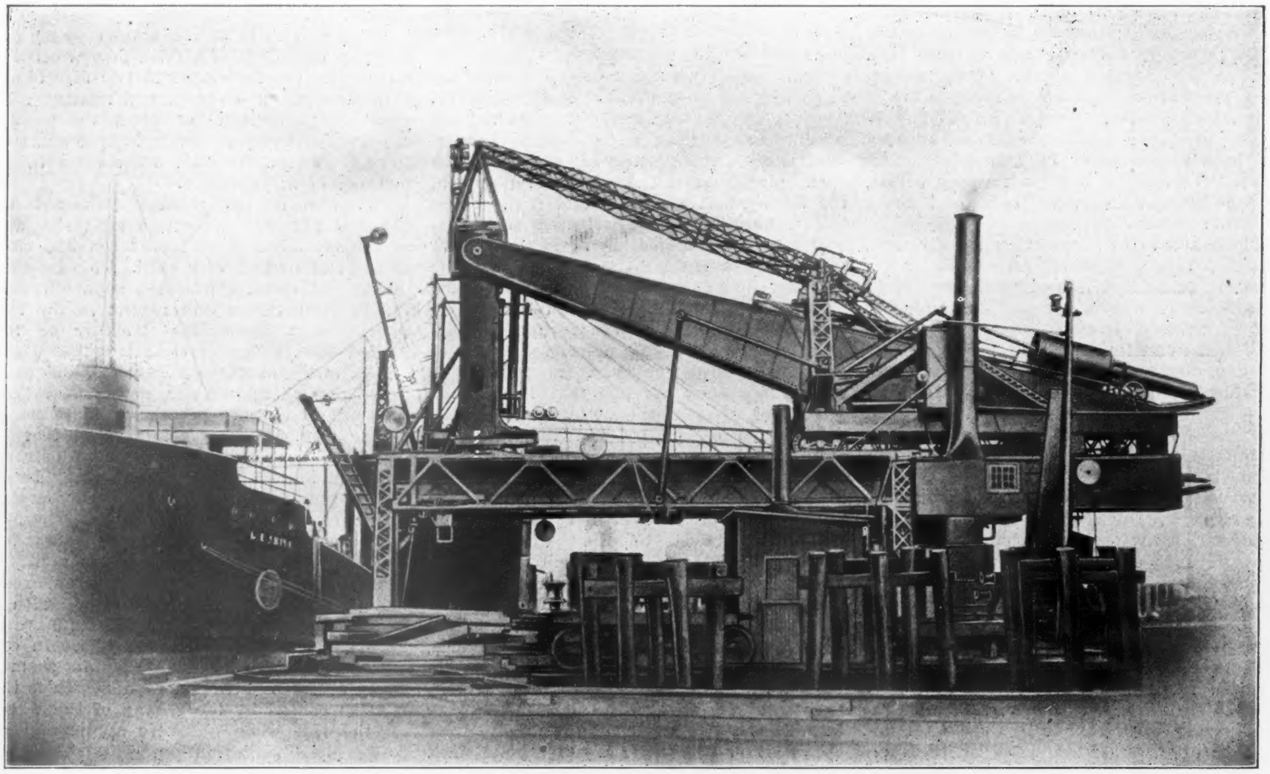
The use of wheels made from inferior material or according to improper methods of manufacture is largely due to the refusal of some buyers to pay prices that will admit of anything else. It is all very well to formulate tests and specifications and to provide rigid inspections for enforcing them, the price will nevertheless govern the quality of wheels purchased as it does in everything else. There are many ways of getting wheels at extremely low prices as well as by keeping down the price paid. For instance, it is usual, in placing current monthly orders, to give an equal weight of old wheels in exchange. By raising the price charged for such old wheels without a corresponding increase in price paid for new wheels, the net cost is lowered. The enforcement of guarantees may be carried out in a way that will provide a large part of the new wheels required, not only without cost but with the added advantage of all of the service obtained from the wheels replaced. Special practices of this kind have largely become the vogue among some buyers and have compelled some wheel makers to cut the cost of manufacture to the lowest possible limits regardless of results. Most wheel makers refuse such business or try to avoid taking it, but it is a fact that some purchasing agents have been able to establish any conditions, right or wrong, in these respects, and to find makers willing to supply wheels under them. When it becomes a contest between such buyers and makers as to which can get the advantage, the car wheels produced are not likely to be safe or economical. With the interchange of cars, and wheel renewals made indiscriminately, this question is one of vital importance to every railroad. No doubt if the facts could be ascertained, the efforts of some buyers to procure good bargains in car wheels would be found to have produced such a number of wrecks and derailments as to far outweigh any advantage obtained by such methods. The moral responsibility for accidents is in such cases generally placed by the buyer on the wheel maker on the score of reputation, guarantees, etc., and by the maker it is placed on the buyer who, it is claimed, must expect to get what he pays for. This is a disagreeable phase of the whole question but one that must be plainly stated. There are not many such buyers or wheel makers, but a very few of them can scatter the results of their practice over a very wide territory, and it behooves railroad officers generally to remedy such conditions as far as practicable. It is useless to provide the most costly and expensive equipment for passenger traffic and run it side by side with freight equipment provided with inferior material. There have been too many illustrations of what is involved in such practice. To avoid accidents all equipment must be maintained in good order, and the advance in quality of all material used must be proportionate to the increasing requirements of service. Every failure to secure this order of practice simply invites disaster.

There is not the slightest doubt that chilled wheels equal to and beyond any of the present demands of service can be readily obtained by railroads that are willing to pay for them. No more striking proof of what is practicable and indeed necessary in this direction can be afforded than by consideration of the fact that the entire net cost of wheels for a car is less than $25. Eight chilled wheels 33 in. in diameter weighing 600 to 700 lbs., less scrap value, which can always be realized at 50 per cent. of first cost, will not exceed the net cost stated. This is less than 5 per cent. of the average cost of the new car.

The chilled wheel makers have certainly done their part in reducing the cost of building and operating American railroads and there must be some limit to the further demands on them to produce still better results regardless of conditions.

Hulett Ore Unloader of the B., R. & P. at Buffalo.

The Buffalo, Rochester & Pittsburg does a large business hauling iron ore from Lake Erie to the Pittsburg district. The cost of handling this business is largely affected by the cost of unloading the ore from the ships to the cars. Previous to 1903, all ships at the Buffalo terminus were unloaded by hand and hence the cost was high. In 1903, however, extensive improvements at the Buffalo docks were completed, these improvements consisting chiefly of the installation of a complete Hulett unloader plant, a description of which is given below. This plant, which was designed and built by the Wellman-Seaver-Morgan Company, of Cleveland, Ohio, has now been in satisfactory operation for over two years, and it has been the means of greatly decreasing the cost of unloading the iron ore.



Hulett Ore Unloader for the B., R. & P., Buffalo, N. Y.

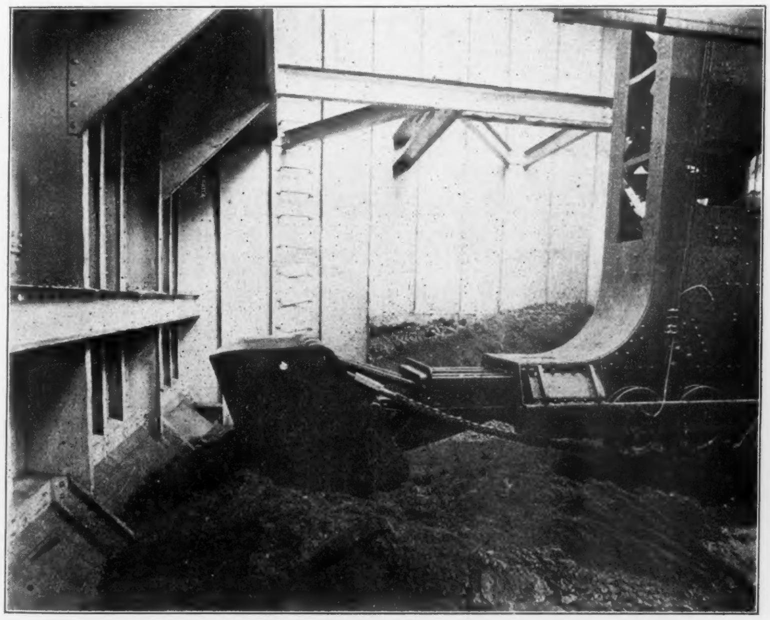
The dock upon which the machine is lo-

cated is comparatively short, making it necessary to use four stub tracks beneath the machine, as shown in the general elevation herewith. Ore can thus be unloaded into cars on either one of these tracks, the normal capacity of the machine being about 2,000 tons per day of 10 hours.

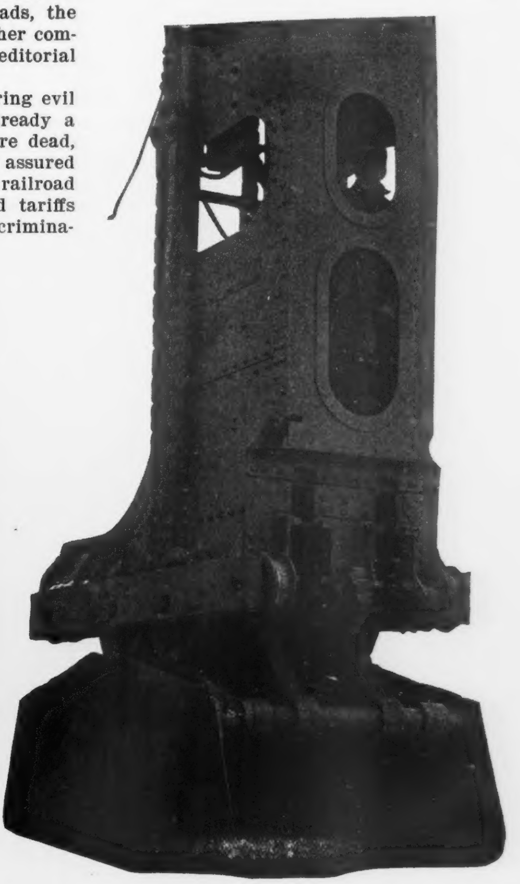
The unloader consists essentially of two parallel girders at right angles to the length of the dock, mounted on trucks. These girders support the trolley or carriage which in turn carries the walking beam. The outer end of the walking beam supports a vertical leg provided at the lower end with a Hulett bucket. The bucket leg is always suspended in a vertical position. The operator rides in the bucket leg just over the bucket and, therefore, goes into the boat at each trip. From his position he can see the working of the bucket and control its movements. By means of a hoisting mechanism, the walking beam is made to oscillate up and down, carrying the bucket up over the hatch or down to the bottom of the hold. When the bucket reaches the pile of ore in the boat it is closed and filled with ore, after which the leg is raised and trolleyed back over the hopper on the dock into which the contents of the bucket are discharged. From the hopper, the ore is dumped into an auxiliary "bucket car," which in turn transfers the ore to the cars, while the bucket is returning to the hold for another load. The bucket leg is mounted on rotating trunnions in the walking beam so that the bucket can revolve and reach out in all directions beneath the hatch.

The bucket has a capacity of about 10 gross tons and a speed of 60 buckets in 40 minutes has been obtained. The usual speed is about one trip per minute and is easily maintained. The bucket has a spread of 18 ft. 3 in., with an additional scraping motion of 2 ft. 11 in., thus making it possible to reach more than half way from the center of one hatch to the center of the next considering 24-ft. centers of hatches. The bucket leg also travels lengthwise of the hatch so as to reach both sides of the boat. In an ordinary ore carrying boat no difficulty is experienced in reaching 90 per cent. of the cargo, and in some of the modern boats, 97 per cent. has been unloaded without the help of shovelers. The bucket operator controls all the movements of the machine except the travel from hatch to hatch and the operation of the "bucket car." These later movements are controlled by another man.

An hydraulic pump and a steam boiler, each of 175-h.p. capacity, furnish the necessary power. Hydraulic cylinders furnish the power for hoisting, for lowering, for trolleying and for rotating the bucket. Excessive pressure on the water bottom of the boat is prevented by the use of a counterbalance cylinder. Each hydraulic cylinder has automatic plugging valves which stop its motion at the end of the stroke. An auxiliary steam engine is used for moving the machine along the dock and for operating the "bucket car."



Leg of Hulett Unloader in Hold of Boat—B., R. & P. Docks, Buffalo.



Leg and Bucket of Hulett Unloader—B., R. & P. Docks, Buffalo.

Rate Legislation from a British Viewpoint.

Mr. William M. Acworth contributes an interesting letter to the *Statist* (London), which is reprinted below in full. Mr. Acworth was sent by the British Government as a delegate to the International Railway Congress, and while in this country made a somewhat special study of the present relations existing between the railroads, the shippers and the government. Further comment on his letter is made in the editorial columns:

One thing is clear: The most glaring evil in American railroad history is already a thing of the past. Secret rebates are dead, and seem likely to stay dead. I was assured on all hands, and not only by the railroad men themselves, that the published tariffs are being strictly adhered to. Discriminations in the form of excessive mileage allowances for private cars, unjustifiable concessions out of a through rate to the private branch lines leading into factories and works—these no doubt still exist. But the evil is now recognized and admitted, and legislation to strengthen the hands of the railroads in putting a stop to it will be welcomed by everyone.

The real question at issue is much deeper and more vital: How far is the Federal Government to assume and exercise that constant and complete control and supervision over the rates for interstate traffic which the governments of the several states have long possessed in theory, and in many cases exercised in practice, over the rates for traffic within their respective limits? And if the Federal Government takes control, to what extent and by what machinery is that control to be exercised? On this point, as far as I can ascertain the railroad men as a whole seem to be out of touch with public opinion; some—not, I think, many—of the wisest and most far-seeing amongst them regard legislation conferring further powers of regulation upon the Federal Government as not merely inevitable, but as actually desirable. That the public at large take this view I have no doubt whatever. But the great mass of the men who have made, and now control, the American railroad systems think—and, doubtless, rightly think—that they are better able to adjust the rates to the rapidly developing circumstances of their great country than any outside authority, however able and disinterested. They point out, with justice, that what has made America is low rates, and that Government interference tends always to concern itself with proportion rather than with quantum; that Government officials care not so much to secure lower rates as to secure the right proportion between existing rates. So far as I can judge, there is much less prospect now than there was at the time of the President's original message to Congress of a bill passing, based on a substantial understanding between the railroad interest and the Administration.

If it be permissible to an outsider to criticise, I greatly doubt whether, as a matter not of abstract theory, but of practical politics, the railroad interest is adopting the wisest course. That the President means to pass a railroad regulation bill may be taken

as certain. That public opinion is behind him is, I think, equally clear. With the support of the railroad men a good and moderate bill could, I believe, be passed. Governor Cummins, of Iowa, for instance, told the Senate Committee a few days ago that the sentiment of the Northwest had not been so little hostile to the railroads for 30 years past as it is at this moment. But if the bill is passed in spite of the opposition of the railroad interests, and without the help which they alone can give in settling its details, the bill runs some chance of being neither good nor moderate.

After all, a disinterested student of the question, even if, like the present writer, he is persuaded that Government interference makes for higher rates and less public convenience, must admit that in the United States at the present time there is a strong case for Governmental interference. One man—the President of the Pennsylvania Railroad—dominates the great industrial region which enters in Pittsburg. Two men—Mr. Hill and Mr. Harriman—dominate the development of the entire Pacific slope. Admitting to the full the benevolence of their despotism, they are still despots, and to despots, however benevolent, the Anglo-Saxon race has never yet taken kinaly. And on the whole history shows that the Anglo-Saxon race has not been far wrong.

It may be that legislation will be staved off for tne present. For one thing, there is more than a possibility that the agitation will be "switched off" on to tariff revision. For another thing, the Senate is obviously not inclined to pass any radical measure, and a measure drastic enough for the President to recommend may be too drastic for the Senate to accept. But even so the question will only be postponed. It may come up again in a few years' time, when the country is less prosperous and worse tempered, and when conservative forces have less influence than at present.

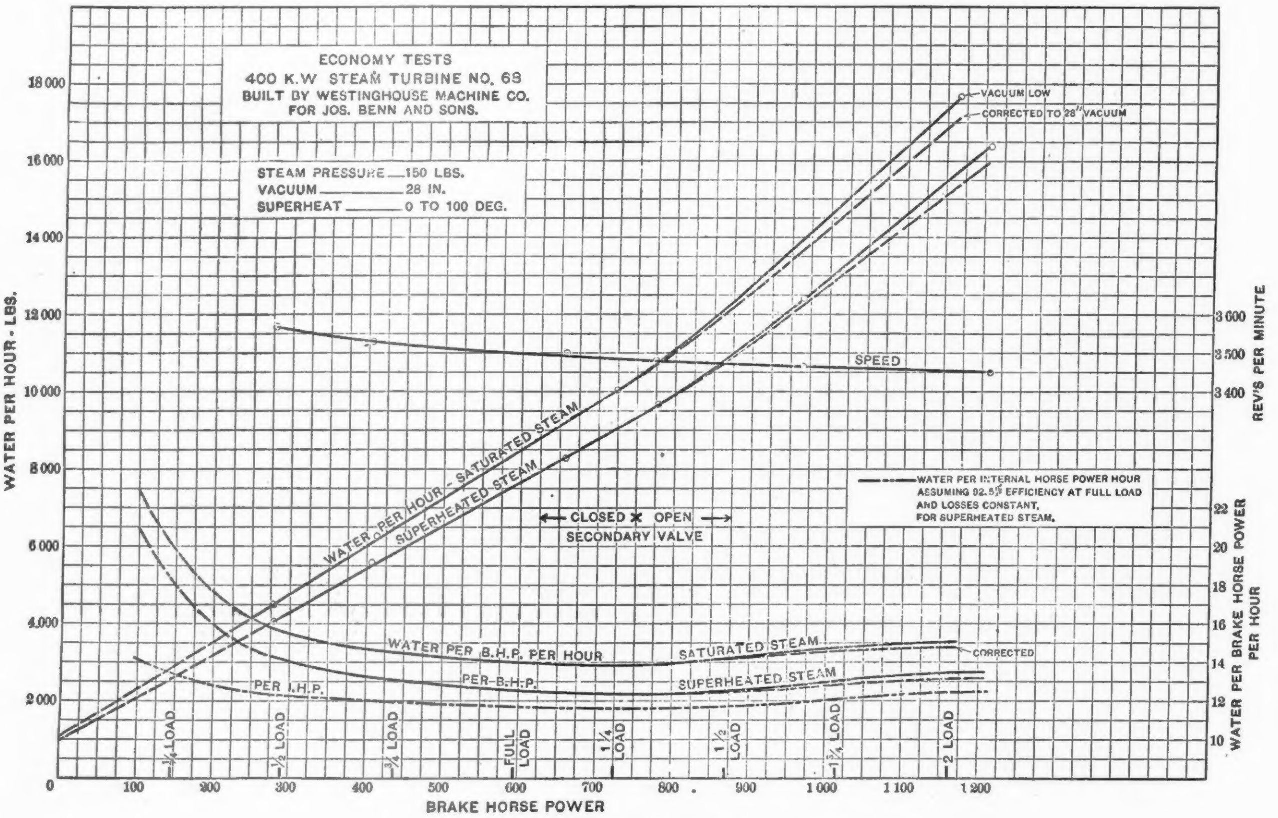
If any bill passes at all, it is likely, from all I hear, to be somewhat on the following lines. The Interstate Commerce Commission will be strengthened. Its members will be appointed for life, paid less inadequate salaries, and railroad men will cease to be ineligible for dealing with the subject which they, better than anyone else, understand. To the reconstituted commission, power will be given not merely (as at present) to say that a rate is unreasonable, but to say what rate can reasonably be substituted. This new rate will, subject to an appeal as of right to an ordinary law court (which must be taken at once and brought forward for immediate decision), be for twelve months the rate which the railroad company is bound to charge. After the lapse of a year the company recovers its liberty of action, and may reimpose such a rate as it thinks proper.

No one can, of course, say in advance how such a law would work. If the commission confined themselves to dealing with individual rates for specific commodities, it is evident that a century of work would not enable them to scratch the surface of the freight situation. If, on the other hand, they started out to readjust the long-established percentage relation between the New York-Chicago rate and that from New York to St. Louis, Cincinnati, Cleveland, etc., they could work a revolution within three months. Probably they would, like most other responsible bodies in a difficult situation, steer a middle course—interfere more than the railroad men desired and less than the public expected. But I think, if I were at this moment in charge of a great American railroad property, I would sooner take the risk of rash action by a reconstituted commission than stave off all interference now, with the chance that a few years hence whips might be replaced by scorpions.

Westinghouse-Parsons Turbine Tests.

The Westinghouse Machine Co. has recently completed a 400 k.w. steam turbine for Joseph Benn & Sons, of Providence, R. I., which was tested for efficiency by a representative of the purchasers. The whole equipment that was ordered consisted of a Westinghouse-Parsons steam turbine of 600 nominal horse-power direct-connected to a Westinghouse 400 k.w. polyphase generator of the revolving field type. Both the turbine and the generator are of the standard construction employed by the builders for machines of this type.

As it was particularly desired to determine the efficiency of the turbine independent of the generator, separate tests were made on the two. To insure the utmost accuracy, brake tests were made on the turbine. The exhaust steam was condensed in a surface condenser and weighed. As the steam was furnished by a boiler plant situated at some distance from the turbine, a superheater was used, thus making it possible to furnish dry, saturated steam to the machine, and the tests were run with both superheated and saturated steam. The load varied from twice the full load to one-half the rated load. The steam pressure was 150 lbs. per sq. in., and the vacuum ranged from 26.6 in. to 27.35 in.

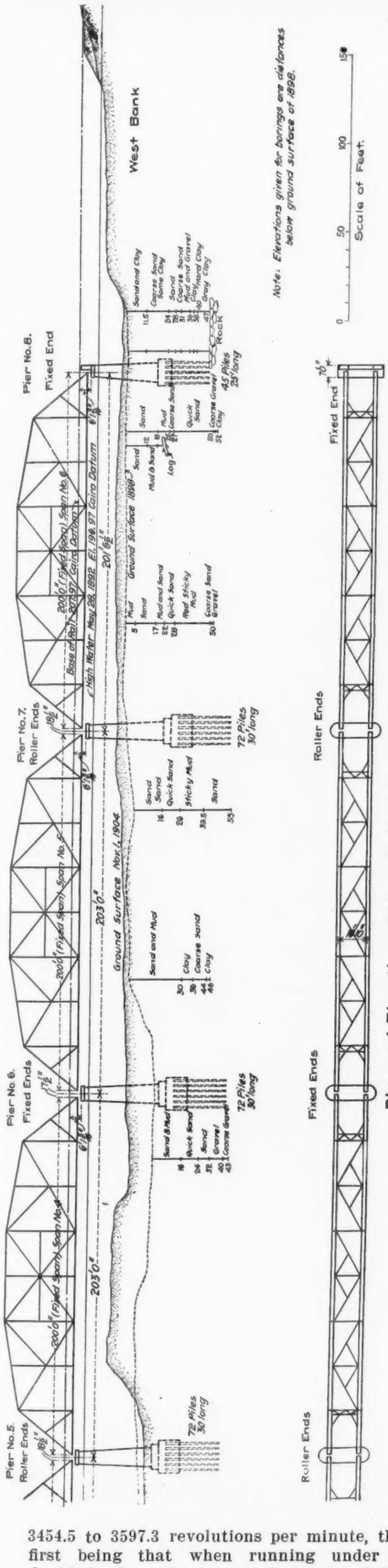


Economy Tests of a Westinghouse Steam Turbine.

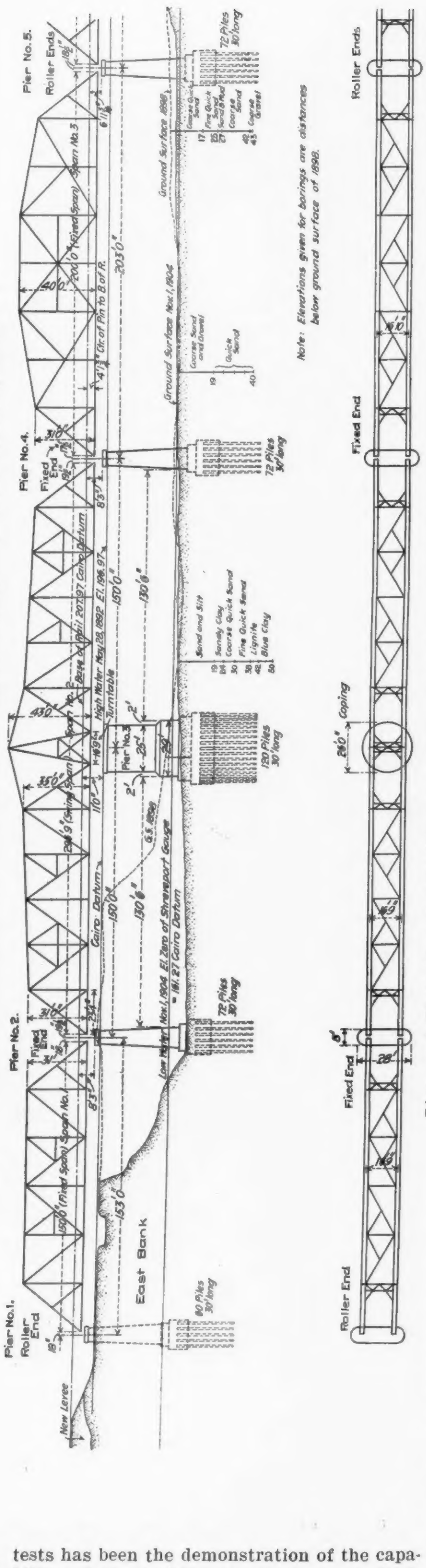
The following table gives the principal results obtained:

Load.	Brake H. P.	Steam per B. H. P. per hour.
With Superheated Steam.		
Double	1,207.5	13.55 lbs.
One and one-half	967.5	12.79 "
One and one-quarter	777.6	12.41 "
Full	657.3	12.48 "
Three-fourths	410.7	13.45 "
One-half	279.4	14.34 "
With Saturated Steam.		
Double	1,165.6	15.12 lbs.
One and one-quarter	725.9	13.85 "
Full	660.0	13.89 "
Three-fourths	414.6	15.05 "
One-half	281.6	15.86 "

During these tests the speed varied from



Plan and Elevation of West Half of Shreveport Bridge—St. Louis Southwestern.



Plan and Elevation of East Half of Shreveport Bridge—St. Louis Southwestern.

3454.5 to 3597.3 revolutions per minute, the first being that when running under a double load on the saturated steam and the latter when using saturated steam at half load. These results are better than the builders' guarantee, which was 14.8 lbs. for full load with superheated steam and 16.4 lbs. for full load with saturated steam.

One of the most valuable features of these tests has been the demonstration of the capability of the turbine to carry an overload. An overload of 100 per cent. was carried with excellent economy. This is brought about by an automatic secondary governor with which the turbine is fitted, and which only begins to operate when the load has reached about 700 h.p. This feature makes it possible for the machine to operate at its best economy at full load and still provides ample means for sustaining large overloads.

In the matter of regulation the speed increased over the normal full-load rate, 3.55 per cent. at no load, and 1.29 per cent. at half load, and fell off 1.03 per cent. at 1½ overload, so that the extreme variation between one-half load and 1½ overload was 2.32 per cent.

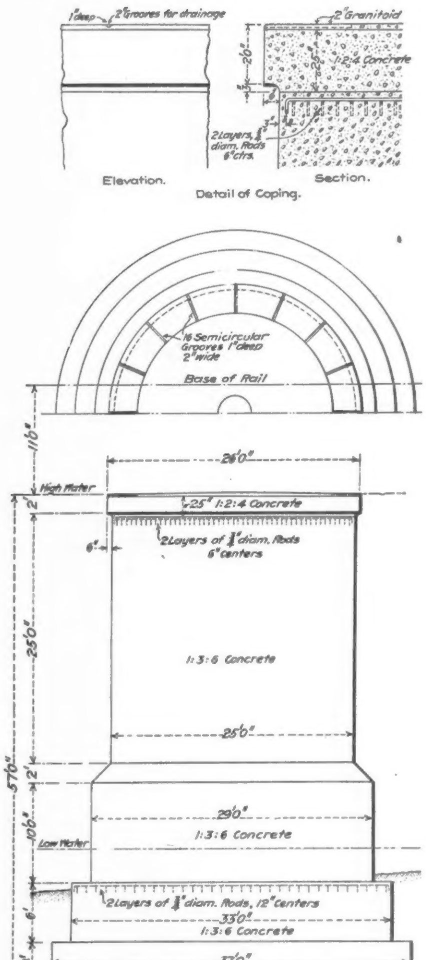
A diagram is given showing graphically the difference in the results obtained by the use of superheated and saturated steam. Such results as these will go very far to establish the claims made for the turbine of high steam economy for the consumption of steam per brake horse-power that is here shown, drops well below good compound condensing practice with reciprocating engines and crowds very closely upon the best that is possible with triple expansion.

The St. Louis Southwestern Bridge at Shreveport.

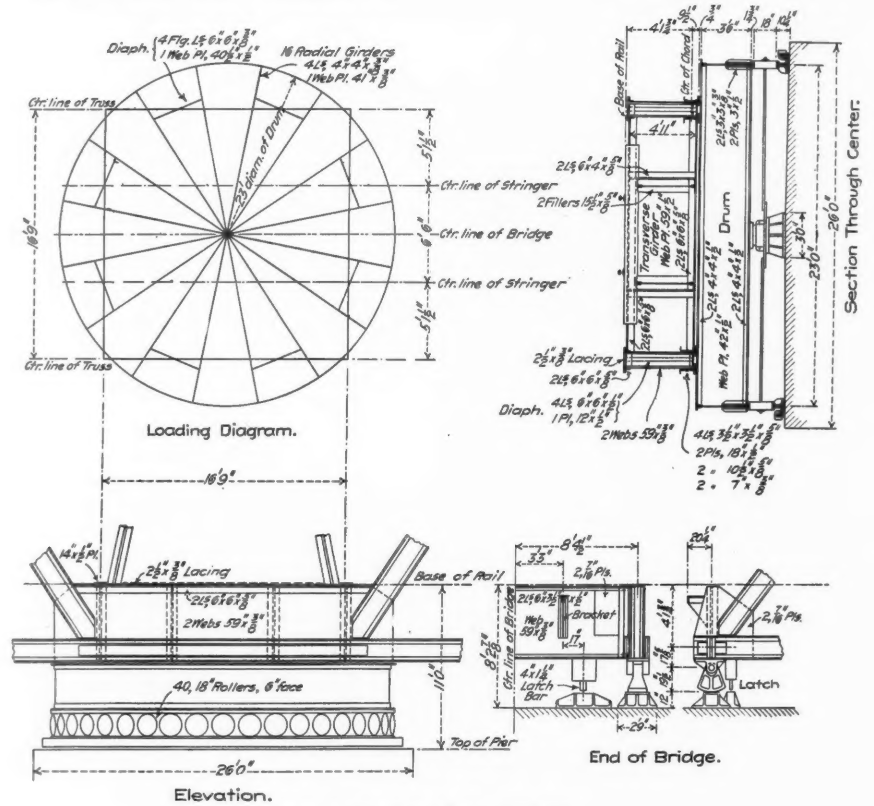
The Shreveport, La., branch of the St. Louis Southwestern Ry., which was built in 1898, leaves the main line at Lewisville, Ark., and runs almost due south parallel to and east of the Red river, crossing the latter just before entering Shreveport. Up to the present it has been using the bridge of the Vicksburg, Shreveport & Pacific Ry. This bridge, which was built in 1887, was a remarkable structure in its day, containing some features far in advance of current practice. It was designed for the road, of which Mr. G. F. Bouscaren was then Chief Engineer, by the late Mr. C. Shaler Smith. The loading provided for an engine of 80 tons (including tender) followed by 2,000 lbs. per lineal ft. of track, or about one-half of the present loads. There are no adjustable members in the entire structure, and all members subjected to counter stresses are riveted members. The bridge is carrying present loadings satisfactorily.

The original survey for the St. Louis Southwestern's bridge was made at the time the branch was built—seven years ago. The ground surface at that time is indicated on the elevation drawing by a broken line. It will be seen that this river is fully as unreliable as the Missouri, shifting its channel with equal ease and rapidity. Since the 1898 survey was made the river has encroached on the east bank to an extent that required moving the entire bridge a distance of 150 ft. in that direction from its original location. The bank has been cut away at the rate of 20 ft. a year. In anticipation of further cutting, the east pier is designed and built exactly as the channel piers to provide for adding another (shore) span should it become necessary.

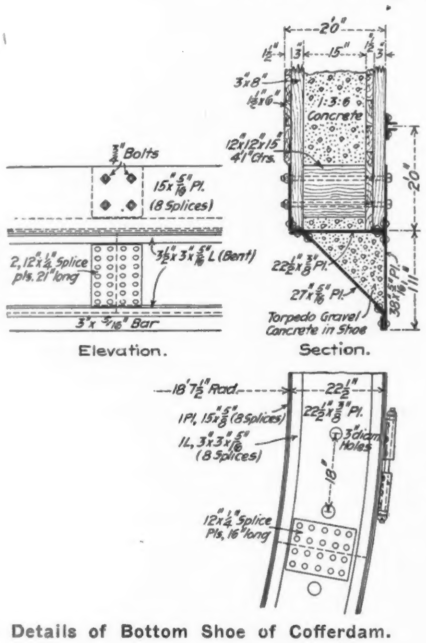
The borings showed sand, gravel and clay. All piers have pile foundations and are being sunk by means of cofferdams. The center or pivot pier, will have a circular cofferdam, details of which are shown. It is a concrete cofferdam, 41 ft. in diameter outside and 36 ft. high. The inner and outer walls are formed of 3-in. x 8-in. vertical studs sized one side and one edge and cut in 12-ft. and 24-ft. lengths. The inner side of each wall is lagged with 1½-in. material sized to 1¼ in. The primary purpose of this lagging is to tie the studs together, making a much more substantial structure. It is bound outside with three hoops or bands as shown. The two walls are tied together by ¾-in. bolts passing in pairs through 12-in. x 12-in. x 15-in. wooden blocks spaced 6 ft. on centers vertically and 6 ft. 1½ in. horizontally, except the bottom ones, which are



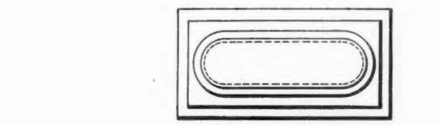
Details of Center Pier for Swing Span.



Details of Swing Span Mechanism.



Details of Bottom Shoe of Cofferdam.



Plan and Elevation of River Piers.

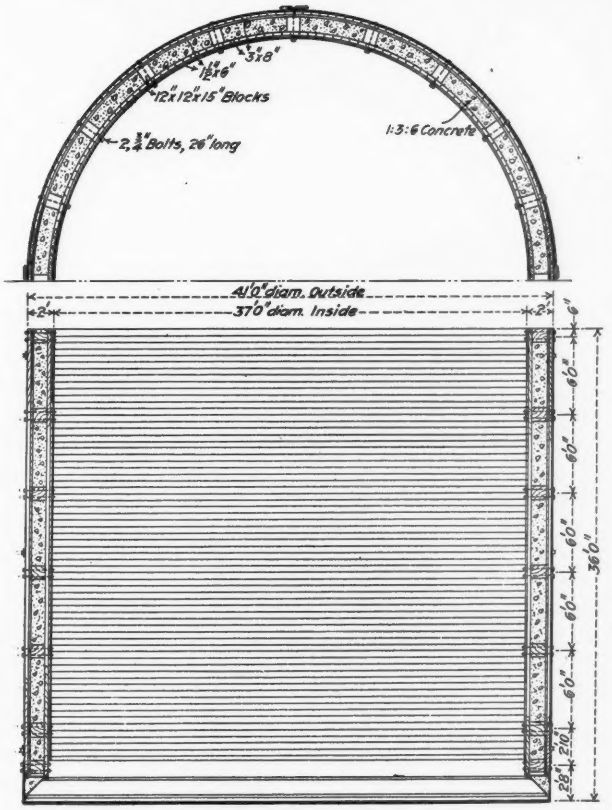
4 ft. 1 in. The shoe is formed of plates and angles as shown in the detail. It is filled with a 1:3:6 mixture of torpedo gravel concrete which is inserted through 3-in. holes spaced 18 in. centers in the top plate of the shoe. The space between the cofferdam walls is filled with a 1:3:6 mixture of concrete to give the dam the requisite weight.

Drawings of a fixed-span pier and the pivot pier are shown. The specifications for the Portland cement concrete for these piers are the American Railway Engineering and Maintenance of Way Association's standard. At the top of the footing and also just below the coping of each pier is a network of ¾-in. iron rods spaced 12 in. centers both directions to prevent the formation of cracks from unequal settlement.

The superstructure consists of four 200-ft. spans, one 150-ft. span and a 296-ft. 9-in. swing span, the total length of the bridge being 1,265 ft. The trusses are of a mongrel construction, with pin-connected bottom chords and riveted connections for upper chords and web members. In the floor-beams no bends are used. All material is cut straight to avoid bends and waste, and thereby reduce cost. The swing span is rim and center bearing, being of the Detroit turntable type. All gears are cast-steel and the ends will be lifted by means of eccentric rockers. Although this type of end-lift was first used 25 years ago, on the Sabula bridge of the Chicago, Milwaukee & St. Paul by Mr. Shaler Smith, and is said to be the only one that permits the ends of the span to expand and contract freely without sliding on the tops of the piers, it is only now being appreciated and adopted by bridge builders. The swing span is to be operated by hand,

but provision will be made for gasolene power for turning the bridge, lifting the ends and operating the rail wedges. The latter will be operated directly by compressed air. The span will be protected by manual interlocking signals, the home signals being placed at its ends. The estimated weight of metal in the structure is as follows: 150-ft. fixed span, 285,000 lbs.; four 200-ft. spans, 1,770,000 lbs.; swing span, 715,000 lbs. Total weight, 2,770,000 lbs.

The bridge was designed and is being built under the supervision of Mr. J. W. Schaub, Consulting Engineer, Chicago. The Missouri Bridge & Iron Company, Leavenworth, Kan., has the contract for the substructure, and the Phœnix Bridge Company, for the superstructure. Mr. M. L. Lynch is Chief Engineer of the railroad, and also of the Shreveport Bridge & Terminal Company, the name of the company under which the work is being executed.



Cofferdam for Center Pier of Swing Span.

Vanderbilt Lines Freight Car Repair Pool.

It was announced some time ago that on July 1 a freight car repair pool would be organized by the associated Vanderbilt lines. The operation of this repair pool will be through a clearing house under the immediate charge of Mr. Eugene Chamberlain. A small book of instructions stating the method which will be used in apportioning assessments and credits for the different roads in the pool has been issued, and through the courtesy of Mr. Chamberlain and Mr. Frederick H. Meeder, chairman of the committee which worked out the details of the organization, we are enabled to give here a brief outline of the scheme.

The following 19 roads are associated in the pool: New York Central & Hudson River and leased subsidiary lines; Boston & Albany, St. Lawrence & Adirondack, New York & Ottawa, Ottawa & New York, Dunkirk, Allegheny Valley & Pittsburg, Lake Shore & Michigan Southern, Lake Erie, Alliance & Wheeling, Lake Erie & Western, Northern Ohio, Indiana, Illinois & Iowa, Michigan Central, Big Four, Peoria & Eastern, Cincinnati Northern, New York, Chicago & St. Louis, Pittsburg & Lake Erie, Rutland, Indiana Harbor. All these roads have contributed their entire freight car equipment to the pool. Charges are apportioned among them not on the basis of the number of cars contributed but in proportion to each road's share of the gross mileage made by all cars, both pool and foreign, over the roads in the pool.

The expenses of the pool are divided under four heads: (1) interest, (2) foreign car hire, (3) repairs, (4) lubrication. The cost of each of these items is calculated for the entire pool. The figures thus obtained are then divided by the total gross mileage made by all cars on all the pool roads. This gives the rate per car mile for each of the four items. This rate per car mile for each item is multiplied by the freight car mileage made on each of the separate roads. If the product is in excess of any road's actual expenditures as reported under each head, that road becomes a debtor and must equalize by paying the difference to the creditor road or roads. In like manner if its proportion of any of the items is less than its actual expenditures, it becomes a creditor and receives the difference from the debtor roads.

All freight equipment, including cabin and caboose cars, is turned over to the pool, but all other company cars used for such purposes as maintenance of way, wreck trains, locomotive cinder hauling, etc., together with a few special cars, are excluded.

Among the roads in the pool per diem will not be charged, but instead each road will be credited with interest on the equipment turned into the pool. Interest at the rate of 4.8 per cent. per annum, or .4 per cent. per month, is to be allowed on the total valuation of the equipment contributed by each road to the pool, and this interest will be credited monthly to the owners of the cars by the clearing house. It will thus constitute a charge against the pool. The rate per car mile for interest, obtained as previously outlined, when multiplied by the mileage of each road will give the proportion of the total interest which is debited to each road, and the difference between the amount thus obtained and the credit which the road has for interest on the equipment turned into the pool determines whether its balance is a debit or credit. In determining the valuation of cars contributed to the pool when it goes into effect on the first of July, all cars which are 14 years 9 months old, or under, are to be charged on the basis of the prices for new cars allowed under the M. C. B. rules less depreciation at 6 per cent. per annum on the depreciated value. All cars more than 14 years 9 months old are to be put in at M. C. B. prices according to their class and capacity, less 60 per cent. depreciation. For the new cars purchased by any of the roads and turned over to the pool at any future time their actual cost will be credited to such road. When cars which have been turned over to the pool are destroyed or withdrawn, they will be charged off at the current valuation of new cars of their class. Interest in all cases will begin with the first day of the succeeding month after new cars have been placed in service.

The settlement of foreign car hire is also included among the duties of the clearing house. The amounts received each month for the use of pool cars on foreign roads and the amounts paid for the use of foreign cars on pool roads will be reported to the clearing house by each road in the pool. The amounts paid by all roads in the pool and the amounts received by all roads in the pool will be added together and a balance struck. This balance will be used for determining the rate per car mile. This rate per car mile will be multiplied by the car mileage on each road and the difference between each road's proportion and its actual balance of car hire receipts or payments will determine the balance, either debit or credit.

In determining the charges for repairs the amounts expended by pool roads for repairs will be reported to the clearing house each month. The total charges thus reported will be divided by the total mileage of all freight cars, both pool and foreign, to obtain the rate per car mile. This rate multiplied by the total car mileage of each road, as in the case of equating interest and car hire charges, will give the proportion chargeable to each road. The difference between this proportion and the road's actual charges determines the balance.

The cost of lubrication includes the cost of all freight cars, including foreign cars, but exclusive of the special cars mentioned previously, which are not turned over to the pool. Each road will report the amount expended for lubrication and the debit or credit balance will be determined as in the previous cases.

The reports of the clearing house covering repairs and lubrication will be made on a special form, which will itemize, as follows:

(a) Labor—including the wages paid for repairing all classes of pool and foreign cars. This will also include charge for all labor in and around car shops in handling material and a proportion of the time of material inspectors. It will also include a proportion of the wages of general foremen and the office force in charge of car repairs.

(b) Material—including the cost of all material and the freight charges thereon, which is used in the repairing of all classes of pool and foreign cars; also a proportion of the cost of tools and material used by car repair men, such as jacks, levers, sledges, etc.

(c) Inspecting—to include the wages paid for freight car inspectors at all points on pool roads.

(d) Inspecting Material—to include all material such as hammers, lamps, wrenches, jacks, etc., used in inspecting freight cars.

(e) Oiling, Labor—including wages paid for lubricating all freight cars and a proportion of wages of oil room attendants.

(f) Oiling, Material—including oil, tallow, waste, sponging buckets, oil cans, etc., used in connection with the lubrication of freight cars.

(g) New Cars—including the total cost of rebuilding all freight cars to fill vacant numbers in the pool equipment.

(h) Bills Due to Foreign Roads—to include all bills passed for car bodies or trucks of foreign roads destroyed on the pool road and bills passed in favor of foreign roads for repairs to cars made by them under M.

C. B. rules for the account of pool roads.

(i) Clearing House Expenses—including salaries, furniture, rent, stationery, etc., of the clearing house, to be apportioned on the basis of the car mileage of each road.

The circular sets out a number of charges which would usually be included under the head of maintenance of freight equipment but which do not properly belong in the pool account. Some of these are, extraordinary expenses involved in the application of new or special devices for the first time on existing or re-built cars, such as friction draft gear, air-brakes, etc.; royalties on patent rights, premiums on insurance, wages of wrecking gangs, etc. Certain credits are properly chargeable to the pool account and others do not properly belong to the pool account. These are set forth in the instruction book. The credits properly belonging to the pool account are: scrap material from repaired or destroyed pool and foreign cars; amounts charged against foreign roads for pool cars damaged and destroyed; and amounts charged against individuals and companies for special repairs to cars. Amounts received as insurance on cars destroyed do not properly belong to the pool account and are not credited.

The following are some miscellaneous instructions included in the circular:

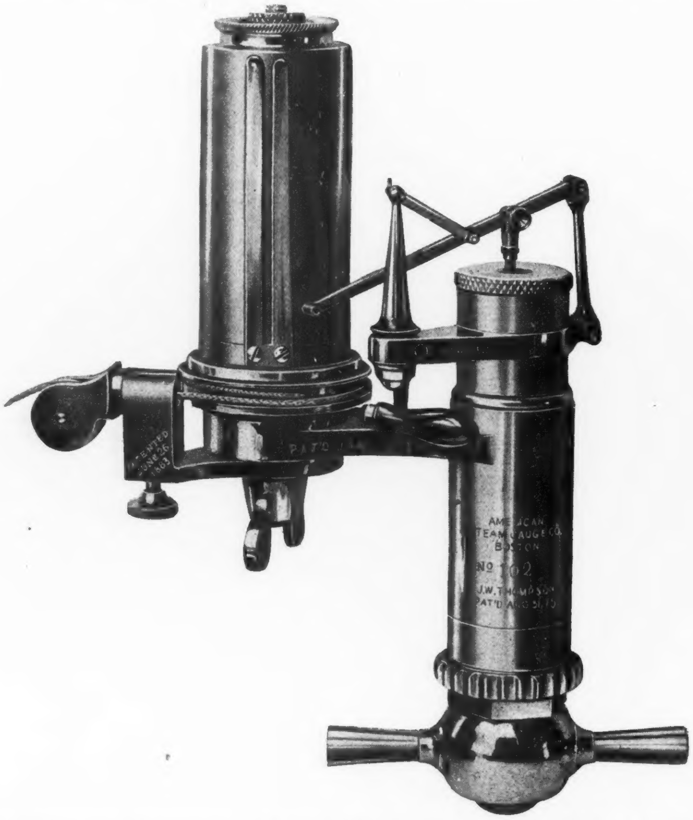
No bills for the repairs of pool cars will be exchanged between pool roads. Pool cars will be repaired at the most convenient pool shops, the cars of other pool roads to receive the same care and attention as home cars. Inspection between pool roads will be for safety only and must cover all requirements of the Safety Appliance Acts. Cars rebuilt at other than home shops will be billed against the owner, who will make the charge to the pool. Material shipped by one pool road to another will be billed against the road doing the work and in turn charged by the latter to the pool when used.

To avoid undue expenditures on worn-out pool cars, the consent of the owner should be obtained before making general repairs to such cars. Each road in the pool will control the rebuilding and replacement of its equipment. Pool cars destroyed on pool roads should be reported promptly to the car owner, but no bill rendered, and the owner should advise promptly as to the disposition of trucks.

The expenses of each month will be apportioned among the pool roads on the basis of the total car mileage of the previous month. Statement of clearing house balances will be sent to the authorized officer of each pool road not later than the 16th day of each month; and settlements for same should be made on or before the last day of the same month. Pool road defect cards (except for wrong material) will be detached from both pool and foreign cars, whether repairs are made or not. M. C. B. repair cards issued by foreign roads for repairs to pool cars should be removed from the cars if proper repairs have been made. If it is found that improper repairs have been made, joint evidence should be obtained and forwarded to the owner; the repair card to remain on the car and notation made on it to indicate that joint evidence has been obtained.

An Improved Detent Motion.

The accompanying illustration shows the American Thompson indicator as fitted with an improved detent or stop motion. This attachment is especially desirable when taking cards from locomotives, gas engines or high-speed stationary and marine steam engines, as with it it is possible to connect the indicator to the high-speed reducing motion and stop the drum of the indicator without unhooking the cord or stopping the engine. Cards may be taken in rapid succession, this being particularly desirable on tests where the load is variable such as on locomotive tests. In making a test of this kind it is important, during certain periods of the test, to get as many cards as possible. With an ordinary indicator not equipped with the improved detent motion it is almost impossible to take as many cards as should be taken in order to get accurate results of the test. The locomotive indicator is fitted with a 1½-in. paper-drum, and the detent motion is contained within the paper-drum and is operated by a lever below the drum-carriage. To stop the paper-drum, the lever is moved in the direction traveled by the drum. When released it is returned by an auxiliary spring to a position ⅛ in. beyond the end of the stroke, thus making it impossible for the drum to engage until desired. The drum carriage having the full beyond the end of the stroke by the auxiliary spring. The lever is then returned to its original position, allowing the pin to elevate again. When the card is changed and ready to take another diagram, the drum is turned forward by means of the milled rim on top. This causes the pin to engage the hole, being guided by an incline causing the drum to rotate in the usual manner, the motion being smooth and without shock, there being no chance to break the cord as with the old style pawl and ratchet detent motion. The parallel motion used in connection with this indicator is the original Thompson parallel motion; the ratio of the lever being three to one, makes a very stiff and rigid motion, making it impossible for the slightest error to escape being shown in the diagram. The piston and other working parts of the instrument are made as light as is practical to make them. The piston head and steam cylinder are made of special mixture of composition which



The American Thompson Indicator Fitted with Improved Detent Motion.

tension of the main drum spring continues to rotate in the usual manner and thus prevents any whipping or sagging of the cord. This allows the indicator to be used with the detent motion in connection with a reducing wheel connected directly to the indicator. The drum is supported on the spindle by means of a collar held stationary by a pin engaging the slot in the spindle, on which rotates an outer sleeve, which acts as a bearing and guide for the drum. To the stationary collar is fastened the inner end of the auxiliary spring, the outer end being fastened to the auxiliary spring case, which is held stationary in the paper-drum. The tension of this spring causes the drum to return to its position before the return stroke of the drum carriage. When in action the drum is controlled by a pin engaging a hole in the grooved wing at its bottom. By turning the lever, this pin is lowered on the return stroke of the drum carriage, releasing the drum, which is returned gives an equal expansion under the varying thickness of metal; this is particularly desirable in reducing friction at this point. The American Steam Gage & Valve Mfg. Company, Boston, Mass., are the makers of both the American Thompson improved indicator and the improved detent motion.

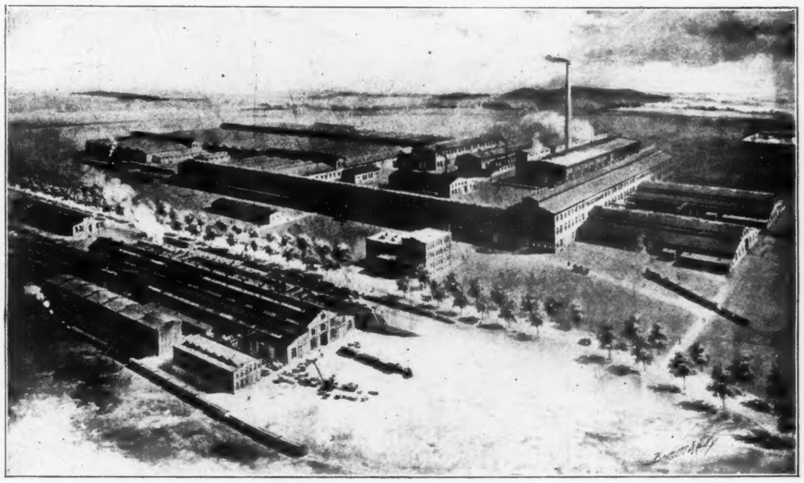
Railroads in Nova Scotia.

The report of the Provincial Government Engineer for the year ended Sept. 30, 1904, shows that the railroads of Nova Scotia are divided into three classes, as follows: (1) Those owned and operated by the Government of Canada, which are controlled by the Minister of Railways; (2) those which are owned and operated by private companies but have, by special act of the Dominion Parliament, been declared to be for the general benefit of Canada and which come under the jurisdiction of the Railroad Com-

missioners; (3) the class with which the report deals, the remaining railroads not specially designated, which come under the jurisdiction of the Province of Nova Scotia. The first class includes the Intercolonial, with a mileage in Nova Scotia of 467 miles. The second class includes the Dominion Atlantic, with a mileage of 231 miles. The third class includes nine railroads, with a total mileage of 391½ miles, the longest of these being the Halifax & Southwestern, 96 miles, which has, since the publication of the report, taken over the Halifax & Yarmouth, 50 miles. The report shows a gradual improvement in traffic on all the roads, although on the Sydney & Louisburg there is an apparent large decrease due to a new system of accounting by which the company makes no returns for company freight, which is evidently the large majority of its traffic. Maintenance of way varies from $170 per mile to $1,200 per mile for all the roads, being from $400 per mile to $1,200 per mile for the roads whose main traffic is coal and from $170 per mile to $210 per mile for the roads with ordinary traffic. The cost of locomotive service varies on the different roads from 20 cents to 60 cents per train mile. On the coal roads where the loads are much heavier, this figure is 33 cents to 60 cents, while on the roads of ordinary traffic it is 20 cents to 25 cents. Traffic expenses, which correspond in general to conducting transportation, for all the roads vary from 11 cents to 29 cents per mile. On the Halifax & Southwestern, earnings per mile were $614 in 1895 against $951 per mile in the year just closed, an increase of 50 per cent. in ten years. The table of accidents for the year ended December 31 shows that no passengers have been killed during the year and only one injured. Two employees were killed and nine injured during the same period. At present, extensions of the Halifax & Southwestern system are under contract, which when completed will give this company a line from Halifax south along the shore through Liverpool to Barrington, thence north and northwest through Yarmouth to Victoria Beach, a total of about 300 miles. The expenditures on the part of the province for railroad subsidies and loans were $1,001,667 during the past year, against $200,000 in 1900. The total earnings on the 347 miles of line reported were: From passengers, $150,144; from freight and live stock, $259,597; miscellaneous, $16,975; total $426,716, or $10,004 per mile per month. The totals for the previous year were considerably larger, owing to the change in the method of accounting of the Sydney & Louisburg, already mentioned.

The New Works of the Ingersoll-Sergeant Drill Company.

The Ingersoll-Sergeant Drill Company has just completed a new plant at Phillipsburg, N. J., located about 1½ miles east of the city, on a large tract of land. The general layout of the plant is shown in the accompanying illustration. The buildings are arranged so that future additions may be readily made and so that the labor required for the handling of machine parts, materials, supplies, etc., between the various departments is reduced to the minimum. An elaborate system of tracks, consisting in all of about four miles, connects the buildings. The tracks in many cases run directly into the shops and under the cranes. The buildings are all of brick, except the pattern shop and storage, and the carpenter shop, which are of New England mill construction. Electric drive is used throughout, the large machines being direct-connected and the smaller machines group-driven. The rock drill department has a floor area of about 123,000 sq. ft. It is a single story structure and is provided with a saw-tooth roof. The construction of the windows used in this roof is shown in the accompanying illustration, as is also the arrangement of the motors used for group driving. The compressor erecting shop is 320 ft. long and has a clear height of 44 ft. under the roof trusses. It adjoins the two compressor manufacturing buildings and the shipping department. It is provided with large electric traveling cranes, and an interesting feature of the shop is the arrangement of the crane runways. These run over and under each other so that materials can be transferred entirely by cranes from any part of the compressor department to any part of the shipping department, thus obviating the necessity of trucking or manual labor. The blacksmith shop contains five steam hammers ranging from 800 to 2,500 lbs. capacity, and a number of jib cranes are provided for handling the heavy forgings to and from the fires. A narrow gage track system also runs through the shop. The waste gases from the furnaces are used in a waste heat boiler which furnishes steam for the hammers, and a double system of blast and exhaust pipes is provided at the opposite side of the shop for the small fires. These fires are used principally for the drop hammers and presses.



New Works of the Ingersoll-Sergeant Drill Co., Philipsburg, N. J.

The company makes all of its castings, some of which are very large and more or less complicated; especially those of the compressors. Therefore a great deal of attention was given to the foundry as one of the most important departments of the plant. The building is 160 ft. wide by 500 ft. long and contains two 86-in., one 78-in. and one 68-in. cupola, all of which are supplied with motor driven blowers. There are also eight core ovens included in the foundry equipment.

The pattern shop is two stories high. The pattern storage house is of mill construction. The floors are of 2½ in. loose tongued plank covered with a layer of asbestos fireproof paper, on top of which is placed the floor, which is of 1¼-in. tongued and grooved yellow pine. The roof is of 2½-in. loose tongued plank covered with four-ply felt and slag. The building has three floors and is divided into seven fireproof sections, each section having three rooms, making 21 storage rooms in all. Double self-closing fireproof doors are provided between each room, and the windows are fitted with wired glass and fireproof frames. A centrally located hydraulic freight elevator having a 10-ft. x 12-ft. platform serves the two upper stories.

The boiler room equipment consists of three batteries of two 250 h.p. Stirling water-tube boilers, and additional space is provided for two extra batteries so as to provide for an eventual capacity of 2,500 boiler h.p. The boilers are fitted with Roney stokers and are fed through chutes by means of an elevated coal storage which consists of a series of hoppers of the Berquist suspension type. The delivering chutes have a measured capacity of about 450 lbs. and are provided with shut-off valves at both ends. Thus the consumption of coal is readily obtainable by keeping a record of the number of chutefuls delivered to the stokers. The coal is delivered from the receiving hopper and crusher to the elevated bunkers by a McCaslin self-dumping conveyor. The conveyor is arranged to handle either coal or ashes. The ashes are received on the conveyor in the basement, and are dumped through a special chute at the top of the outside elevated hopper. The conveyor is operated by a motor and the speed of the buckets is about 40 f.p.m. The engine room equipment consists of three 300-k.w. Crocker-Wheeler direct-current generators, each driven by a 400 h.p. direct-connected Cooper-Corliss cross-compound engine; a 100-k.w. Crocker-Wheeler generator driven by a 100 h.p. engine; one Ingersoll-Sergeant Class H duplex compressor, 24½ in. x 16 in. air cylinders, and one Class C Corliss compound air compressor, with 48-in. stroke, equipped with the Ingersoll-Sergeant Company's air moved valve gear. The general electric distribution system is a two-wire system operating at 240 volts. The power circuit to each building is controlled by a circuit breaker, and the lighting system to each building is controlled by switches and fuses. The lighting system, which is of 110 volts, is obtained by using a Crocker-Wheeler three-wire balancer. The majority of the heavier machines are equipped with Crocker-Wheeler variable speed motors, using the four-wire multiple-voltage system of that company.

Foreign Railroad Notes.

The Hungarian State Railroads are preparing, it is said, to make their car springs in their own shops, and the manufacturers are up in arms about it.

Dr. von Wittek, the Austrian Railroad Minister, resigned May 1, and Ludwig Wrba, a high official in the Ministry, of many years standing, has been appointed in his place. Both these ministers have spent their life in the service of the state, and most of it in positions connected with the railroads.

The Southwest Pass Jetties.

BY H. W. PARKHURST.

About 28 years ago New Orleans was furnished with a channel 20 ft. deep by the work then in progress at the South Pass jetties, and since that time the city has had an era of extended commerce, increasing not only in the tonnage carried, but in the size and draft of the vessels employed. For the five years ending Dec. 31, 1905, the tonnage averaged annually 3,000,000 tons, carried in 2,000 vessels. The constant increase in the size of the boats used, and the narrowness of the pass, averaging but 650 ft. in width throughout the whole length, emphasized the need of a wider and deeper channel. This could only be had by the improvement of another pass. The insufficiency of South Pass for traffic had been foreseen by Captain Eads, who originally proposed to jetty Southwest Pass, and who, in fact, offered to give up the work on South Pass after it was well underway, and to build jetties at Southwest Pass; but he was not permitted to do so, owing to the opposition of the United States engineers.

Any larger channel could best be obtained by improving the outlet through the wide, deep and straight Southwest Pass, and attention was therefore turned to it. Numerous estimates had been made for this work, notably one for $16,000,000 by Government engineers. In comparing the probable cost of jetties at South and Southwest passes, these estimates and all former plans were reviewed by Lt.-Col. H. M. Adams, under whom the work now came. A revised estimate with full plans and specifications was prepared and invitations to bid on the brush, riprap and concrete work were sent out, it being decided that the Government engineers should handle directly everything connected with the dredging. Very full and complete specifications were drawn up, forming an integral part of the contract. They are too long to be reproduced here. The following, however, is extracted from them:

LOCATION, GENERAL DESCRIPTION AND SPECIFICATIONS.

Southwest Pass is one of the outlets of the Mississippi River. It is 15 miles in length measured from the Head of Passes Light to the Gulf at East Point, at which point the east bank of the pass ends. The west bank is about 6,000 ft. in advance of the east. From East Point across the bar, and out to 35 ft. of water, is about 4 miles, and from land's end on the west side out to the same depth is about 3 miles.

The Work Contemplated Under these Specifications is:

To furnish all the plant, materials and labor necessary for the completion across the bar at Southwest Pass, of an east jetty about 4 miles in length, and a west jetty about 4 miles in length, to be constructed of brush mattresses weighted with stone and concrete.

The location of the work will be made under the direction of the engineer officer in charge, or his representative, who will also furnish the contractor with detailed drawings of the various parts of the work as they become necessary for him.

For a distance of 17,000 ft. from the beginning or shore end of the east jetty, and 11,000 ft. from the beginning or shore end of the west jetty, a flexible foundation mat, of the type shown in the drawings, will be laid. It will be 2 ft. in thickness and 100 ft. in width. Continuing the jetties to the sea ends, a distance of 4,500 ft., the foundation mats will be 2 ft. in thickness and 150 ft. in width.

The mattresses will be covered with stone sufficient to sink them and hold them securely in place. It shall be distributed evenly over the mats, and the quantity used will be 50 lbs. per sq. ft. for mats in the east jetty, and 40 lbs. per sq. ft. for those in the west jetty:

The foundation mats will be laid throughout the entire length of each jetty before any superstructure is placed upon them.

The superstructure by which each jetty will be built up to the level of mean high water will consist of mattresses of the same type as those used in the foundation, and of the same dimensions, except in width. They will be placed one upon the other, the center line of each corresponding to the center line of the jetty and foundation mat.

The foundation mats will be designated as the "foundation tiers," and each tier of mats thereafter will be known as the 2d, 3d, 4th, etc., tier.

Where only a second tier is required it shall be 35 ft. in width: where a 2d and 3d tier is required the second tier shall be 55 ft. wide and the third tier 35 ft. wide; where a 2d, 3d and 4th tier is required the width of each shall be 75, 55 and 35 ft., respectively, and where a 2d, 3d, 4th and 5th tier is required the width of each shall be 95, 75, 55, and 35 ft. respectively. For the different widths of mattresses the number of double rows of framework will be as follows:

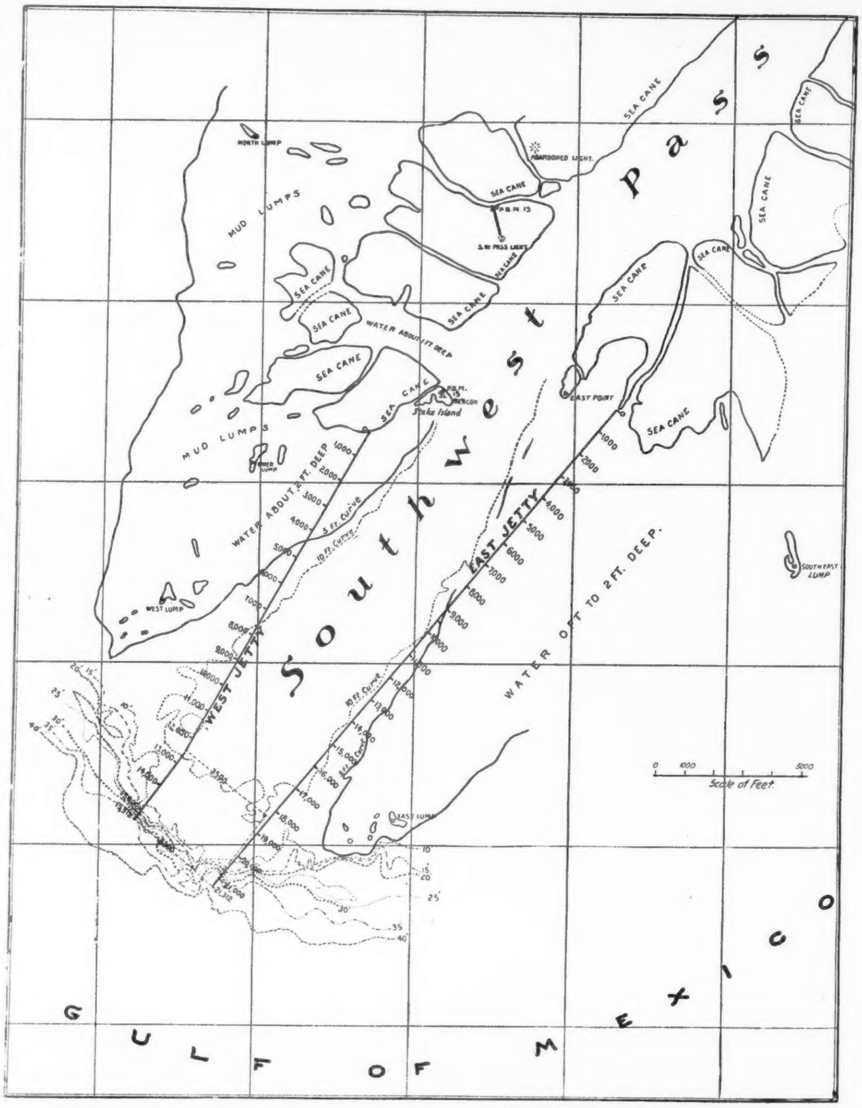
5	rows for a mat	35	ft. wide.
7	" " " "	55	" "
9	" " " "	75	" "
11	" " " "	95	" "
11	" " " "	100	" "
16	" " " "	150	" "

The double rows of framework in each mat must be equal distances apart from center to center.

The same quantity of stone will be placed on the superstructure mats, except the top or surface ones, as on the foundation mats, and on the top or surface mats, in each jetty, 60 lbs. per sq. ft. will be placed, and this amount may be increased at the discretion of the engineer officer in charge.

The mats will be built in sections not less than 200 ft. long.

The mats will consist of a top and bottom framework of merchantable yellow pine as follows: The outside double row, on either side, along the length of the mat, to be of 3-in. x 6-in. scantling. Parallel to this and to each other, and 10 ft. apart from center to center will be placed double rows of 2-in. x 4-in. scantling, and in either case the scantling will be spliced together with $4\frac{2}{3}$-ft. lap joints fastened with spikes and 3 nails in such a manner as will insure the same strength to the frame or binder at the splice as at other parts.



General Location of Southwest Pass Jetties.

Between these double rows of framework there will be placed uprights of 2-in. x 4-in. scantling 26 in. long. The center of the first one will be 6 in. from either end of the mat, the center of the second one 2 ft. from the center of the first, and the intermediate ones to be 5 ft. apart from center to center. These uprights will be fastened to the lower framework by spikes and tree nails, as shown in the drawings, and midway between each of the uprights, which are 5 ft. apart, and between the double framework will be placed a filling piece, 2 in. x 4 in. x 2 ft. and spiked to the framework as shown in the drawings.

On top of the bottom framework, and between the uprights, will be laid three layers of willow brush, each at right angles to the one above and below until the necessary height to give one (1) foot of compressed willows between the outside frames and 16 in. between the inside frames is obtained. The brush or willows must be carefully, closely and evenly laid so as to break joints.

On top of this brush will be placed another framework of scantling in practically the same manner as that on the bottom, excepting that the double rows of 3-in. x 6-in. and 2-in. x 4-in. scantling will be on top.

The top framework will be drawn down by some approved means so as to thoroughly compress the brush between the two frameworks, when the top framework will be fastened to the lower framework by means of the uprights previously mentioned, using spikes and tree nails, all as shown in detailed drawings to be seen at this office. A filling piece will be used in the top framework which will be of the same size and fastened in the same manner as in the bottom framework.

On top of the framework, and extending the width of the mattress, binding poles will be placed at intervals apart as follows: The first one at the first upright of the framework, and the others at every fourth upright thereafter. These poles must be straight, and of slight taper, not more than six or less than four inches in diameter at the butts, not less than $2\frac{1}{2}$ in. in diameter at the tips, and not less than 25 ft. long. They must be spliced together with long scarf joints, using wire nails, and fastened to each upper framework of the mattress by wire, and all in a manner satisfactory to the engineer officer in charge, or his representative. All materials, labor or appliances entering into the construction of the mattress must be covered by the prices named in the bid for "brush mattress."

The mattresses must be placed in a straight line, as directed by the engineer officer in charge, or his representative, and every care taken to insure against one mattress overlapping another and against there being any space between the mattresses.

The mattresses must be so placed that each layer will break joints with the one below it.

The mattresses will be inspected as made, and will be paid for by the square yard when properly in place in the work, and secured by the specified number of pounds of stone to the square foot of mattress. The rip-rap stone will be paid for by weight (in tons of 2,000 lbs.) when in place and accepted by the United States, the weight to be determined by the displacement of scows evenly loaded. To facilitate the measurement, these scows must be fitted with a small well near each end

Fig. 1—Building Mattresses on the Ways.

and one in the middle, as directed by the engineer officer in charge. Should any portion of the stone in a scow, after gaging, be unloaded or placed other than by direction of the engineer officer in charge, or his representative, none of that scow load of stone will be paid for. No pumping or syphoning of a scow shall be allowed from the time it is gaged loaded until it is gaged light, except in cases of emergency, and with the knowledge of the engineer officer in charge, or his representative. It is estimated that 960,000 sq. yds. of mattress and 213,525 tons of rip-rap stone will be required. It is distinctly understood that these quantities are approximate only and may be increased or diminished by not more than 20 per cent., and it is also understood and agreed that any variation within these limits shall not be considered as increasing or diminishing the unit prices for mattresses or rip-rap in place; the contingency of such a variation shall be considered by the bidder in fixing his unit prices.

The engineer officer in charge may, in his discretion, change the specified order in which the mattress foundation and superstructure will be placed, since, during the progress of the work, it may be found advantageous to build certain portions before or after the time they would be built in regular order.

On the completion of the mattress superstructure of both jetties and at the expiration of one year thereafter, both jetties will be prepared to receive a capping of concrete, as follows: The stone on the upper mat will be leveled off and compactly placed for a width of 18 ft., being 8 ft. on the channel side and 10 ft. on the sea side of the center line of the jetty so as to form a foundation for the concrete.

The thickness of the layer of stone on which the concrete will rest will not be less than 2 ft., and if more than the stipulated 60 lbs. per sq. ft. be necessary it shall be added.

The concrete capping will be built in place, and in sections 12 ft. long, the ends being in contact with each other so that practically the capping will be continuous. The intermediate sections will be built after alternate sections are completed; that is, numbering the sections continuously, they will be built in the following order: 1, 3, 2, 5, 4, 7, 6, etc.

The concrete capping will be 12 ft. wide on the bottom, 8½ ft. wide on top, and 4½ ft. in thickness; but may be reduced in section near the shore and increased near the outer ends of the jetties, at the discretion of the engineer officer in charge. It shall be vertical on the channel side, vertical on the sea side for a height of 1 ft. from the bottom, and the remainder of the sea side will form a slope of one to one.

The concrete must be thoroughly tamped in the mould in layers 6 in. thick, and every care taken to secure a smooth surface to it without plastering.

There may be occasions when on account of unusual tide, there will be a tendency of the concrete to escape under the sides of the mould. In such cases a light burlap will be used to prevent such escape. The burlap will be paid for at the current market price.

The proportions of ingredients in the concrete shall be as follows: 1 part cement, 3 parts sand and 5 parts of gravel or broken stone. It is estimated that 65,606 cu. yd. of concrete will be required. It is distinctly understood that this quantity is approximate only and may be increased or diminished by not more than 20 per cent., and it is also understood and agreed that any variation within these limits shall not be considered as increasing or diminishing the unit price for concrete in place; the contingency of such a variation shall be considered by the bidder in fixing his unit price.

* * * * * *

The construction of mat ways and the accumulation of lumber and materials must commence within 60 days after the date of notification of approval of contract, and the sinking of mats commence not later than 120 days after the date of notification aforesaid, and progress, thereafter, satisfactorily to the engineer officer in charge. The entire work of constructing the two jetties must be completed within 4 years after date of notification of approval of contract.

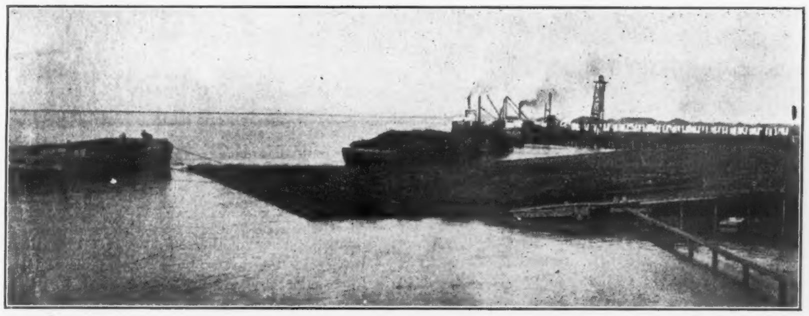


Fig. 2—Launching a Mattress.

East Jetty, Showing Work in Shallow Water.

The contract for the work was let July 16, 1903, and was approved on the 31st of the same month. The successful bidders were Messrs. Christie & Lowe, Chicago, at the following terms:

Brush mattresses, per sq. yd. as per detail plans	$0.96
Riprap, furnished and placed, per ton.	4.00
Concrete, in place, per cu. yd.	6.10

The contract further provided that the work should be finished on or before August 3, 1907.

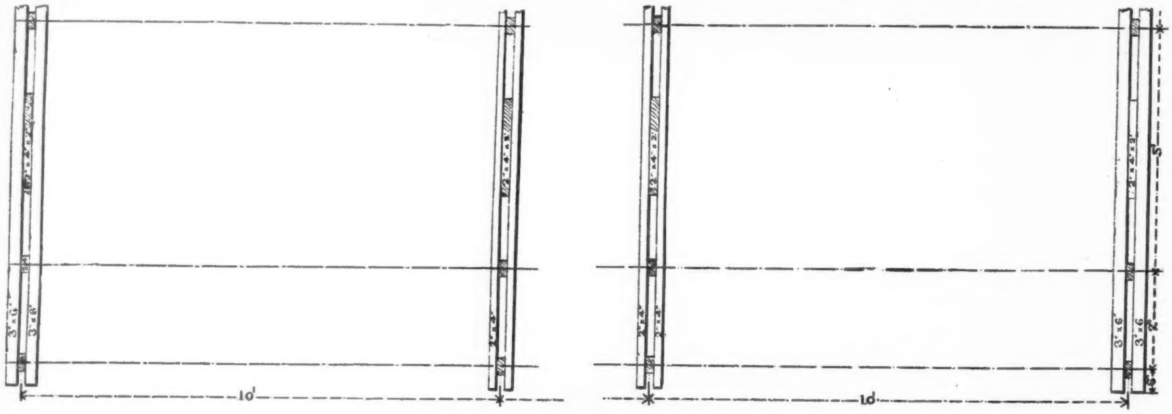
Preliminary estimates made by the U. S. engineers place the cost of the contract work at $2,175,896, but as changes are already being made in the work, especially in the length at the sea ends and in the character of work to be done there, it is most likely that this estimate will be exceeded. The estimated cost of all the work to be done, not including any capitalization for the cost of maintenance (which has been placed at $150,000 per year), was $4,250,000.

Those engineers who were familiar with the very extended and bitter discussions preliminary to the passage of the Act of Congress authorizing the South Pass jetties will desire to know whether the results at that place have fulfilled the prophecies made by Captain Eads, or those of his opponents. From the printed annual reports of the Chief of Engineers is extracted the following information:

(1). That the bar has not built out at the sea ends of the jetties, and it has not been necessary to make annual or other extensions in order to maintain a navigable channel. It is true that there have been deposits at the ends of the jetties, but for 25 years these have been removed sufficiently by dredging at infrequent intervals. The need for dredging has often arisen on account of the formation of one or more of those mysterious "mud lumps," rather than because of the settling of sediment from the river. The results attained justify the opinion expressed by Captain Eads in a published letter written to the Hon. William Windom, in March, 1874, when the latter was chairman of a committee having the construction of a jetty project under consideration, viz.: "That the deposit of the river must tend to shoal the water beyond the mouth, and ultimately to fill up the Gulf itself, is certain, but that it can form a shoal in front of the jetties in this or the next generation is impossible."

(2) That a satisfactory channel has been maintained at no extraordinary expense. . . . The Act of Congress under which Captain Eads built the jetties, provided that he should be paid $100,000 a year for their maintenance after completion, for a period of 20 years. It also held back $1,000,000 from the amount earned in the construction work till the 20 years were over, providing, however, that a portion of this retained money might be available should the cost of maintenance be excessive. In spite of this, the unmistakable fact is shown by the re-

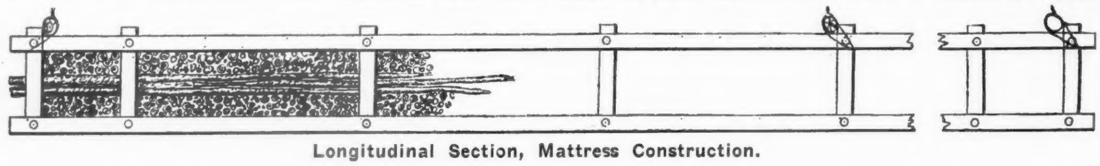
ports that for 92 per cent. of the first 20 years after the required channel, 30 ft. deep, within a channel 200 ft. wide and 26 ft. deep had been attained, there was no deficiency, and the intervals when the channel was not up to the full standard were scattered throughout the whole period, were each of short duration, and the channel was easily restored by a slight amount of local dredging. The depths referred to had to be maintained not only in the jetty channel, but throughout the whole distance from the Head of the Passes to the extreme outer end of the jetty channel in the Gulf. As such shoaling might be caused either by sediment from heavily loaded waters or by the action of southeast gales reducing or changing the



Portion of Two Outside and Two Inside Frames.

currents especially at the sea ends of the jetties, and as the ever threatening "mud lumps" were occasionally responsible for the shoaling, it may be well understood that the most constant vigilance would not always keep the channel at the full standard.

(3) It was claimed that the construction was not sufficiently substantial to withstand the heavy storms so prevalent in the Gulf, and that the jetties would be undermined by the currents. To this objection it may be said that at the end of the 20-year period of maintenance, the United States engineers, under whom the work was done, formally certified that the jetties were intact, that



Longitudinal Section, Mattress Construction.

Cross Section, Mattress Construction.

they had been maintained in that condition for practically the whole period, and that there was but a slight settlement observable by careful instrumental examination. This may well be considered a triumphant vindication of the plans and work, and the contractor should have full credit for the results having produced stability, though working with perishable and compressible materials, and though placing them on a yielding and uncertain foundation.

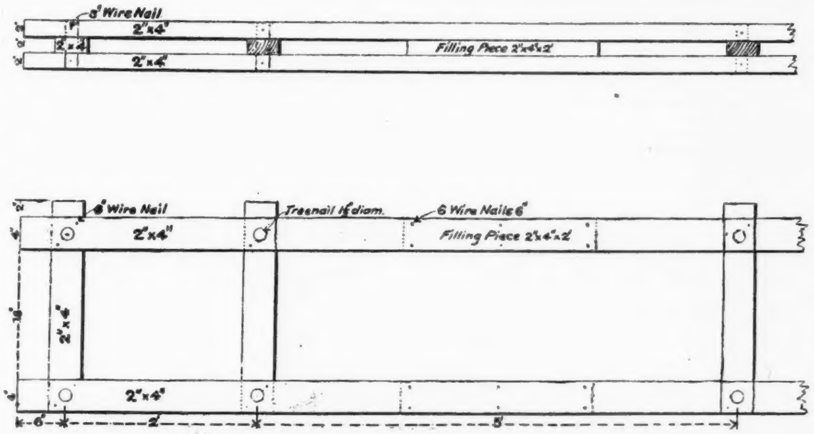
The foregoing discussion of things which relate particularly to the South Pass is given at some length for the reason that the problem was practically the same at the two passes, only much more complicated at South Pass, and the work was hindered by those who should have been its best friends, viz., the United States engineers. The questions which were answered and the problems which were solved in the earlier work do not now need investigation. A comparison of the ground plans of the two passes will show a remarkable similarity. There is the same general shape of the shore lines, the east land's end is shorter and the west extends about a mile further into the Gulf. The widths at the upper ends of the jetties are, in South Pass, 750 ft., and in Southwest Pass, 3,200 ft., which widths nearly correspond to the ratio of the discharges, or 10 and 45 per cent., respectively. At both passes the land, so called, is barely above the level of low water, and is generally submerged at high tide. It is covered with a growth of sea cane and reeds, has few or no bushes and no trees. Only in the case of prolonged northerly storms is there anything that may be called terra firma, and the footing on that is of a very uncertain tenure, being on masses of roots scattered about in the mud. The eye sees nothing but an area of sea cane, reeds, and now and then a "mud lump," or a bit of sand bar.

When the contractors began work, there were no dwellings within two or three miles of the jetty site, and but for the house of the light keeper, no one lived near the work. The first work was to make the place habitable, and piles were driven for foundations for wharves, shops and dwelling houses.

For the purposes of the Mississippi river, jetties are usually built of brush and stone, and are often topped with concrete to consolidate them, and weight them down to withstand the waves and storms. The specifications which were made for the Southwest Pass jetties call for walls of brush, stone and concrete. The very first work on the jetties proper was the driving of piles to establish their location. To do this, floating and creeping drivers both were used. Piles were driven for a trestle to carry a track for handling materials for building the jetty. This was done where there was not sufficient water to float barges on which to carry the necessary materials for the work. Having driven the piles, mattresses were next made and placed. This was done in two ways. Where there was little or no water, the brush and stone were loaded on trains of small cars, hauled on the trestles to the site of the work handled directly to the place where they were to lie, or the mats were built on ways and launched in large or small sizes, as needed, and towed to the proper place for them. The framework for the mats was made and cut by machinery, drills and saws being set to bore and cut at once all or nearly all of the work for each piece. The process of building the mats on the ways is shown in Fig. 1.

The ways were quite extensive, permitting the simultaneous construction of several mats. About one day's work with a fair-sized gang of men is enough to build a mat 200 ft. x 150 ft. These mats are pulled off the ways or tables by a tug pulling on strong lines built into the mats, as shown in Fig. 2, and are then towed by the tug to the site. Once at the jetty, the mat is fastened to the piles in a position next to the last one, carefully moored there, and then sunk by throwing riprap upon it. When the mat is sunk more stone is added from barges in store at the wharf. A view of the east jetty is shown in Fig. 3, giving some idea of the extent of the work. It should be remembered that the east jetty is over four miles, and the west one over three miles long. No photograph can do justice to the "magnificent distances" on this immense construction. When out in the Gulf at the ends of the jetties one needs a well-trained eye to determine his location or to fix his bearings. Powerful glasses only give one glimpses of the work, and any detail must be investigated at short range to determine any essential matter.

The work is approximately one-third done, that is, basing on the original estimates. It is, however, impossible to be exact as to the progress rate, as it has already been explained that there are liable to be a number of changes and additions. It may make it clearer to say that the contractors have been



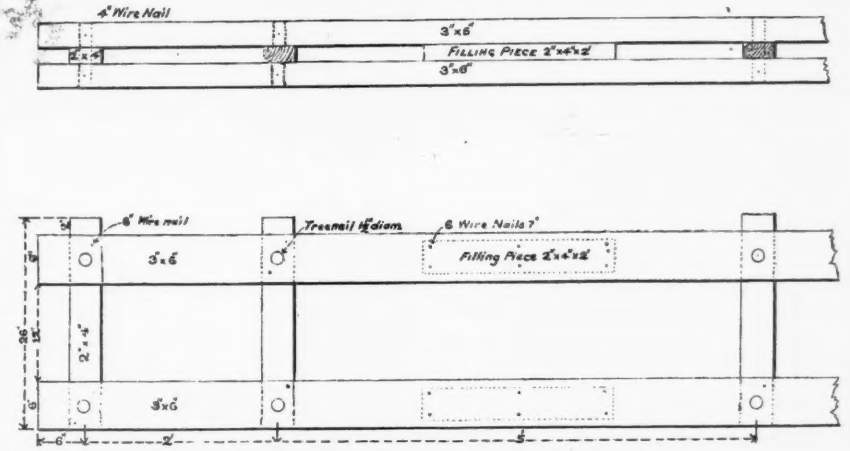
Details of Inside Frames, Mattress Construction.

paid about $1,000,000 up to the first of May, and that their estimates run up to about $100,000 a month. They can easily increase this rate when they are permitted to commence on the concrete blocks. The United States engineers have decided not to permit concreting until the otherwise completed jetty has been standing a year, this being to allow the whole to become perfectly consolidated. This is doubtless an important consideration, and in view of other matters which may not be fully determined, it may be on the safe side to delay this concrete work. It is even a question whether the concrete blocks should be used at all, since, in case of settlement, the repairing of the settled work can hardly be done without leaving some indelible marks showing that the repairs have been made at certain places, whereas, if the covering is of heavy riprap or rubble stone, it can be raised and repaired without leaving any traces of it.

Then, too, there is the question of what to do to prevent the possible destruction or the settlement of the work from the ravages of the teredo. The experience had with these worms is that they do immense amounts of damage under favorable conditions, one of which is the presence of brackish water and another the presence of mud. Both are too plentiful at Southwest Pass to permit the comparatively small saving which would be made by neglecting any necessary precaution in avoiding them. True, it seems to have been the experience at South Pass that little harm, or settlement, has been caused; but we know too little of the teredo to be safe, when he is hungry. Since these worms may burrow the whole length of a stick of wood after they once get in, no matter how deeply the stick may extend under the bottom, it would not be safe to depend on the integrity of the mattresses laid on the mud at the ends of the jetties.

Another point to be considered is that if concrete blocks are not to be used, it may be necessary to arrange with the contractors for a supply of heavier rubble for the extreme outer ends of the jetties, as the class of stone now being used for sinking the mats would be unsuitable for withstanding the strong southeast gales which sweep in over the Gulf.

A brief list of the contractors' plant will also assist in a fuller understanding of the work. A complete quarry has been bought, and from it the riprap stone is being taken.



Details of Outside Frames, Mattress Construction.

It is located near Berry, Ala., not far from Birmingham. At this point there are several thousand feet of track, derricks, engines, drills, pumps, boilers, buildings, etc., for getting out and loading riprap. It is shipped to New Orleans by rail, and there transferred to barges on which it is towed down the river to the jetties. At the jetties are two work trains, two narrow-gage engines and two trains of 20 cars each, all of which run on three or four miles of track, partly on the east and partly on the west jetty. Plying between the jetties and New Orleans and vicinity are four or five tugs, one steam yacht, two or more launches, one or two stern-wheel steamers and about 35 or 40 barges. The latter are used for stone and brush principally, lumber being handled on barges owned and kept in the lumber business. Brush is brought from points as far as 50 miles above New Orleans, and were it not that it grows so rapidly the supply would fall short of the demand. As it is, the second crop is now being cut on some of the land first cleared for willows to put into the earlier mattress work. Twenty-five or thirty houses, shops and stores have been built at Burrwood entirely for use in connection with the work. The force employed averages about 250 men, of whom about half are old employees, the rest being made up by importations from New Orleans and continually changing. Many of the older employees have high salaries and fine positions, and are the best men of this class in the world.

The contractors employ a trained doctor, who gives attention to all minor cases, either surgical or medical. He also pays special attention to the policing of the whole place and sees that sanitary regulations are carried out. Any serious cases are taken to New Orleans for skilled treatment. The care of the men is so good that aside from being a great comfort to the employees it must surely result in more work and more gracious service on the part of the laborers. There is not the least doubt that the work can be finished on time, or even in advance of the date set in the contract. With fair weather, and favorable adjustment of the unsettled questions above referred to, the date could easily be anticipated by six months.

A progress profile of the work is shown in Fig. 15. This shows the condition of the work at the middle of April, as taken from the plats and notes of the Government engineers. It will be seen that the foundation mats are in nearly to the ends of the jetties, and that the upper layers are underway. There is a long stretch on each jetty, where the riprap work is done, ready for the concided. When permitted to build this concrete blocks or other cover, as may be decrete, still greater rapidity of work may be expected. Thus by the end of next year New Orleans will probably be able to rejoice in the acquisition of a channel at least 1,000 ft. wide and 30 to 35 ft. deep, with a central depth of 45 to 50 ft.

As yet the works are not concentrating the current, and there is no material scour; but as time goes on and the other tiers of mattresses are placed and secured, the walls will confine the water to narrower quarters, the velocity will be accelerated and the water will take up and carry the deposit on the bar. Then aided perhaps by powerful dredges, the channel will be deepened, and New Orleans will surpass all the cities of the United States in the depth and navigability of this gateway to her harbor.

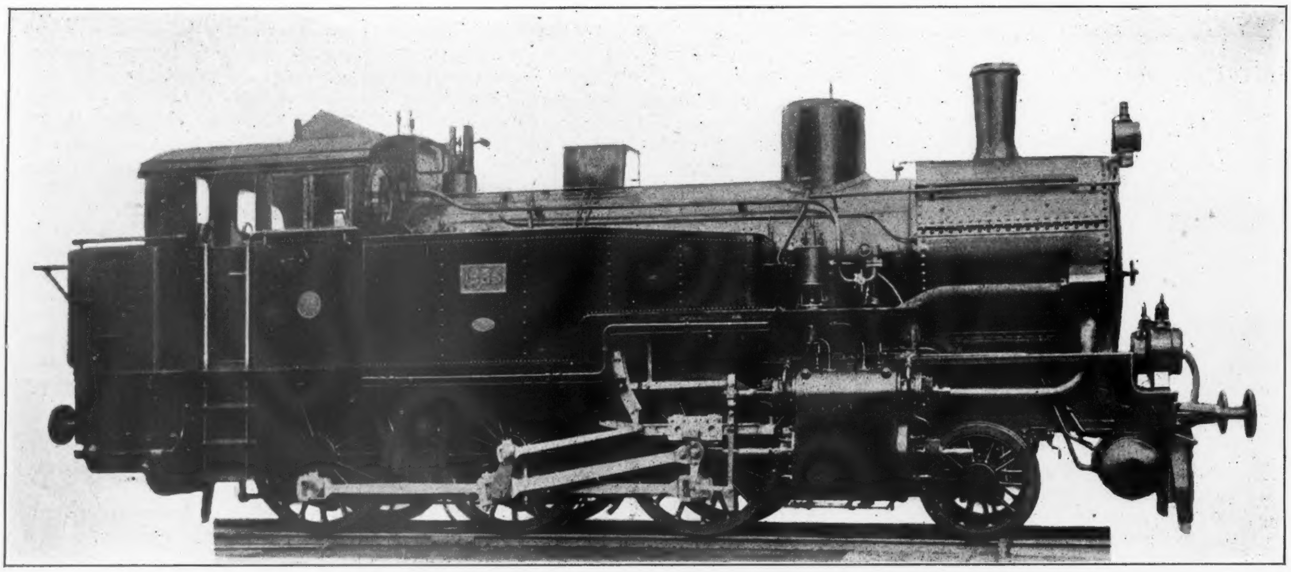
Detail of Jetty Construction.

The Schmidt Superheated Steam Locomotive.

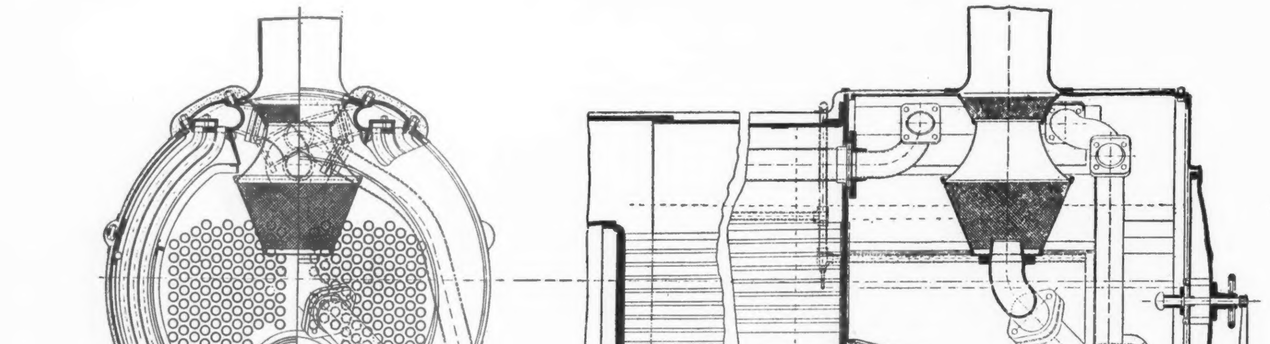
BY EMILE GUARINI.

Wilhelm Schmidt, M. E., of Wilhelmshöhe, near Cassel, has succeeded, in a marked degree, in applying steam highly superheated to locomotives. Beyond the usual advantages resulting from the use of dry steam there is obtained by this system a notable increase of power combined with a great reduction in the consumption of steam. Moreover, the system allows of compounding. These superheated steam engines are in use on the Prussian State Railways. At the end of the year 1904 there were 48 of them under construction and in service. They are built by the Berliner Akt. Ges., formerly L. Schwarzkopf, of Berlin; and also by the Hohenzollern Akt. Ges. at Düsseldorf-Grafenberg. They are, for the most part, engines with from three to four drivers coupled up and used for passenger as well as freight trains; the superheater is placed in the smoke-box and the valves are of the piston type. There are others to the number of 45 which are tank engines used for passenger trains, and built by the Union Foundry at Königsberg and A. Borsig at Tegel, near Berlin. There are also 57 of these locomotives built by the Stettin Machine Building Akt. Ges., Vulcan-Bredow-Stettin, and F. Schichau, Elbing. All these engines have the superheaters in the smoke-box.

This method of construction is based upon the principle of dividing the hot gases into two distinct currents, the division beginning with their exit from the firebox. The main flow of the gas is employed for the general evaporation, the weaker current cools off very little in passing through the boiler tubes but gives up the greater part of its heat while going through the tubes of the superheater, to raise the temperature of the steam. The lower part of the boiler has a flue or large tube through which a second current of hot gases, proceeding from the firebox, is conducted directly upon the superheater. The tubes of the superheater are disposed in three concentric rings within a circular casing placed along the interior walls of the smoke-box, the diameter of which has been increased for the purpose. They are arranged in such a way that the interior ring, by means of a suitable bending of the tubes which comprise it, forms an arch, and it is situated at the mouth of the flue constituting in a way a prolongation of it. This tubular arch or dome is slightly inclined to the axis of the flue, nar-



Locomotive with Schmidt Superheater.



The Schmidt Superheater.

rowing toward the forward end of the locomotive, forming thus a sort of concentrating channel for the superheater. At the upper part of the smoke-box these tubes are let into one or two cast-steel collectors placed on either side of the chimney. In case of there being but one collector it is placed at the rear of the chimney. The superheating space is separated from the other parts of the smoke chamber by a steel plate which may easily be removed if desired. This latter conforms to the shape of the superheating tubes and extends as far up as the collector. It is protected against the effects of the high temperature by the tubular rings placed close by and by the side of the smoke-box, which has protecting plates which counteract the action of the cinders. The long and narrow opening for the escape of the gases is closed on either side by one or more dampers which are operated from the engine driver's seat in the cab. The space occupied by the superheater is protected from loss of heat by a plate attached to the inside wall of the smoke-box, and also by a covering of fibrous asbestos which covers the interior walls and which in its turn is inclosed in a metallic covering. The gases which pass into the distributing channel rise on the right and on the left over the superheating tubes, and when the dampers are opened the gases return to the smoke-box and thence escape through the funnel. The cinders which accumulate about the tubes fall into a hopper which is emptied at the end of the run. Or they may be blown out during the run itself by a jet of superheated steam or compressed air.

The steam when leaving the boiler enters first the collector on the left, from whence it enters the collector on the right after having passed through the interior ring. In this collector a plate covers both the inner rings, and this forces the steam to find its way back into the collector on the left by way of the middle ring. In this collector the two outside rings are closed by a plate and in such a manner as to compel the steam to re-enter the collector on the right by passing through the outside ring, whence it issues highly superheated to find its way into the steam chests of the cylinders.

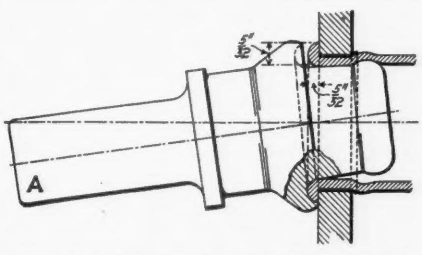
The flow of the steam changes its direction two or three times in its passage through the superheater in such a way that the heated gases at their entrance as well as at their exit come in contact with the surfaces which have been cooled by the passage of the moist steam. The collectors are provided with covers which are easily accessible from the exterior. When these are removed the tubes may be either expanded or plugged up. As long as the throttle is open the tubes of the superheater are constantly cooled by the passing steam; when it is closed then the heated gases are only able to enter it very slowly and then at a low temperature, so that the tubes being no longer cooled by the moist steam are not subject to any destructive action. It is not necessary to close the dampers of the superheater when the locomotive is at rest. This precaution is only needed when the jet is applied with the throttle closed. For this reason the manipulating rod of the dampers is so combined with the jet valve that the dampers are always closed when the jet is in operation.

Except in very rare cases the driver need pay no attention to the superheater during the run. In his cab and in full view is a pyrometer either of steel or mercury which shows the temperature in the superheater, permitting him at once to keep track of the combustion and evaporation. Moreover, the pyrometer gives warning of dirty grate bars or dark spots on the surface of the fire; of excessive moisture in the steam generated, often the result of a high water level or from foaming and impure water. All these conditions affect the superheater. As a general thing the dampers may be neglected as a means of regulating the superheater. Nevertheless, the engineer may reduce the efficiency of the superheater or cut it out altogether by completely closing the dampers. The placing of the superheater should not in the least interfere with the accessibility to the head of the boiler, nor in any way prevent the cleaning or replacing of the tubes.

A New Vibrating Tool for Setting Boiler Flues.

The accompanying illustration, Fig. 1, shows a tool invented and patented by T. V. Freeburg, foreman boiler maker of the Colorado Fuel & Iron Company's Pueblo shops, for beading, prossering and expanding boiler flues. The head of the tool is larger than the diameter of the flue and has a concentric ring cut in it, as shown, for forming the bead. The shank between the beading and prosser forming parts is made long enough to suit any thickness of flue sheet, and its form is such that when the tool is inclined the shank engages with the inside of the flue and tightens it in the sheet. The tool is used in connection with a pneumatic riveting hammer, the shank "A" fitting the hammer the same as a rivet snap. The flue is first nipped at the bottom with a peaning hammer. Starting at this point the tool is inserted in the flue and held at an angle, as shown in Fig. 2. The hammer handle is then rotated, the operator maintaining the angle during rotation. Three rotations are sufficient to finish a flue. A hand rolling is then given and the work is complete. The tool has been found especially valuable in hot work, as no rolling is required and the flue is tightened instantly in three points—in the sheet, the bead and the prosser. It is also claimed that flues worked with this tool maintain their original thickness. H. A. Deuel, Superintendent of the Colorado Fuel & Iron Company's shop at Pueblo, Colo., states that with this tool 170 flues were worked over in 15 min. Sixteen of these were splitting badly when the engine came in. In replacing flues some exceptionally fast work has been done with this tool. In one engine 65 flues were beaded, prossered, expanded and turned over in 10 min., this being a trifle less than 10 sec. to a flue. The Denver & Rio Grande, the Pennsylvania and the Norfolk & Western Railroads are now making tests of it.

A New Vibrating Tool for Setting Boiler Flues.



New Vibrating Tool and Finished Flue.

Exhibits at the Manhattan Beach Conventions.

The smaller exhibits at Manhattan Beach occupy the rear veranda of the Oriental Hotel, while the larger ones are in booths in an open area back of the hotel yard. Many of the latter duplicate the exhibits made at the International Railway Congress at Washington last month, and are therefore quite elaborate. Following is a complete list of those in place up to the time of going to press. The remainder will be printed in another list next week.

Acme White Lead & Color Works, Detroit, Mich.—Enamels, paints and varnishes for railroad equipment; also "Pandect," a rust preventive for steel cars and structural work.

Adams & Westlake Co., Chicago.—Adlake acetylene gas car lighting system; railroad lanterns; non-sweating, down-draft signal lamps; hardware and gas and electric chandeliers. This company also has an exhibit consisting of a demonstration of the Newbold system of electric car lighting from the axle.

American Brake Shoe & Foundry Co., Mahwah, N. J.—Various types of brake shoes showing the development of the brake shoe from 1850 up to the present time. Also a general line of small steel castings, including motor frames, oil cups, wrenches, track tools, etc.

American Lock Nut Co., Boston, Mass.—Burrows' patent lock nuts.

American Steam Gauge & Valve Mfg. Co., Boston, Mass.—Locomotive steam gages; air brake gages; pop safety valves, both muffled and open; and the American-Thompson improved locomotive indicator, fitted with improved detent motion.

American Steel Foundries, New York.—Cast-steel locomotive frames; cast-steel driving wheel centers; Simplex brake-beam; Simplex driving wheel and coach springs; Simplex car and tender bolsters and cast-steel side rods and crossheads.

Atha, Benjamin, & Co., Newark, N. J.—Open-hearth cast-steel truck bolsters—five types, ranging from 40 tons to 50 tons capacity; also section through 40-ton bolster.

Baldwin Locomotive Works, Philadelphia, Pa.—Pacific type 4-cylinder balanced compound locomotive, with 9,000-gal. tender; built for the O. R. & N. Co.

Barnett Equipment Co., Newark, N. J.—The Barnett connector for automatically coupling the steam, air and signal pipe lines between cars.

Bethlehem Steel Co., Bethlehem, Pa.—Samples of staybolt iron showing results of physical tests; hollow piston rod; in halves to show construction; also locomotive crank pins, etc.

Bettendorf Axle Co., Davenport, Ia.—Bettendorf passenger, freight and tender trucks; passenger I-beam truck frame; removable journal box truck frame and riveted arch bar truck frames.

Booth Water Softening Co., New York.—No. 2 railroad type water softening machine of 200 gals. per hr. capacity. The machine is partly shown in section.

Bradford Draft Gear Co., Chicago.—Four-spring and three-spring draft gears; also two small models of spring and friction draft gears.

Buckeye Steel Castings Co., Columbus, Ohio.—Major coupler for freight cars; Ohio coupler with improved unlocking attachment; also a steel truck

bolster for an 80,000-lbs. capacity car. This bolster weighs but 565 lbs.

Buda Foundry & Mfg. Co., Chicago.—Car replacers; ratchet, friction and ball-bearing jacks; anti-friction metals and pressed-steel hand and push car wheels.

Buffalo Brake-Beam Company, Buffalo, N. Y.—The Buffalo brake-beam.

Bullard Automatic Wrench Co., Providence, R. I.—The Bullard automatic wrench.

The Carborundum Co., Niagara Falls, N. Y.—Cases containing carborundum products, carborundum wheels, stones and carborundum fire sand for lining brass furnaces.

Carey, Philip, Mfg. Co., Lockland, Cincinnati, Ohio.—Plastic freight car roofing; building roofing; locomotive boiler lagging; train pipe covering, and magnesia and asbestos goods of all kinds.

Celluloid Co., The, New York City.—Samples of "Texoderm" for upholstering and car curtains.

Chase & Co., L. C. (Sanford Mills), Boston, Mass.—A full line of samples of Mohair plush for upholstering car seats, also "Chase Leather" (an imitation leather) for upholstering.

Chicago Car Heating Co., Chicago.—Full-sized models of the vapor system of car heating in operation.

Chicago Pneumatic Tool Co., Chicago.—Boyer pneumatic hammers, Keller pneumatic drills and other pneumatic tools for railroad use.

Coe Brass Mfg. Co., Ansonia, Conn.—Patent extruded metal in brass and bronze, used for car trimmings, etc.

Commercial Acetylene Co., New York.—Acetylene gas lighting fixtures and apparatus for the storage of acetylene gas in cylinders filled with porous substance and acetone. This system is shown in operation on the I. C. S. instruction car on track.

Consolidated Car Heating Co., Albany, N. Y.—Steam car heating apparatus; automatic steam couplers; automatic traps; heavy valves and fittings; electric heaters; regulating switches, and the McElroy automatic axle lighting system shown in operation.

Consolidated Railway Electric Lighting & Equipment Co., New York.—"Axle Light" system for electric car lighting, showing dynamo running at all speeds without variation in current output or voltage.

Crosby Steam Gage & Valve Mfg. Co., Boston, Mass.—Recording gages, steam and hydraulic gages, safety valves, locomotive chime whistles, globe and angle valves, and Johnstone blow-off cocks.

Curtain Supply Co., Chicago.—Car curtains fitted with Forsyth, Burrowes, Acme, Climax and Ring roller-tip fixtures; also a full line of curtain materials.

Davis, John, Co., Chicago.—Steam specialties; air hose couplings; flexible steam joints; reducing valves; back pressure valves and swing joints.

Davis Pressed Steel Co., Wilmington, Del.—Davis solid-truss brake-beams; also special machine for making rapid service tests.

Dearborn Drug & Chemical Works, Chicago.—Boiler compounds and samples of scale.

Detroit Lubricator Co., Detroit, Mich.—Locomotive lubricators having three, four and five feeds.

Dickinson, Paul, Chicago.—Engine-house smoke-jacks, including "Vitribestos" jacks, cast-iron movable engine-house jacks; also cast-iron ventilators and chimneys.

Draper Mfg. Co., Port Huron, Mich.—McGrath pneumatic flue welder, McGrath turntable motors and Draper valve-facing tools; also a Rockwell flue-welding oil furnace.

Dressel Railway Lamp Works, New York.—Headlights, switch and signal lamps; semaphore lamps with long burning founts, interchangeable classification lamps, and steam and water gage lamps.

Duner Co., Chicago, Ill.—Water closets for railroad cars.

Edwards Company, The O. M., Syracuse, N. Y.—Window fixtures; vestibule trap doors, and tin barrel spring rollers for curtains.

Electric Controller & Supply Co., Cleveland, Ohio.—The Deutsch electric train lighting system.

Electro-Dynamic Company, Bayonne, N. J.—Five h.p. 4 to 1 interpole, variable speed motor, running a 10 h.p., 2 to 1 motor as a generator. Two power station instruments, showing the loads and speeds of the motor. An automatic illuminated flash sign bearing the words "Inter-Pole," surmounts the exhibit.

Empire Safety Tread Co., Brooklyn, N. Y.—Carborundum safety step treads for car steps, marine work, etc.; also carborundum buttons for vault light work.

Everett & McAdam, New York and Chicago.—Thirty-inch electric blue-printing machine in operation.

Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio.—Hollow staybolt bars of various diameters in 10-ft. lengths; also samples of raw materials from which the bars are rolled.

Farlow Draft Gear Co., Baltimore, Md.—Twin and tandem designs of draft gears as applied to steel and wood sills; malleable a, d wrought iron draft gear details and M. C. B. couplers, with reinforced slots; also Westinghouse friction draft gear as applied to Farlow attachments; twin design of cast-steel sills as applied to 1,000 D., S. & S. cars.

Federal Manufacturing Co., Elyria, Ohio.—The Keeler eccentric and pinch handle car curtain.

Flannery Bolt Company, Pittsburg, Pa.—The Tate flexible staybolt and special tools for applying the same.

Foster Engineering Co., Newark, N. J.—New class G reducing valves for train and marine service; pump governors; high pressure valves; float valves; back-pressure valves and non-return stop valves.

Foster, The, Walter H. Company, New York.—The Lassiter staybolt threading and reducing machine; also sample of work.

Forsyth Bros. Co., Chicago.—Radial coupler centering device; Chaffee coupler centering device, and safety deck-sash ratchets.

Franklin Railway Supply Co., Franklin, Pa.—McLaughlin lock nuts, McLaughlin metal flexible conduit, Worthington coupler, Franklin driving box lubricator; Franklin pneumatic fire-door openers; Franklin car journal box, and Worthington emergency couplers.

Frost Railway Supply Co., Detroit, Mich.—The Harvey friction draft spring.

Garlock Packing Company, Palmyra, N. Y.—Full line of fibrous and metallic packings for locomotive and general railroad use.

Gold Car Heating & Lighting Co., New York.—Car heating and car lighting apparatus.

Goodwin Car Co., New York.—Working model of the Goodwin gravity dumping car and drawings of 100,000 capacity, Class "R" coal car.

Gould Coupler Co., New York.—Gould Z-beam steel platform for passenger cars; friction buffer draft gear; freight car couplers; journal boxes; car bolsters and draft arms and friction draft gear; tandem draft gear, for wood and steel sills; spring buffers and tender couplers and brake-beam clamps.

Gould Storage Battery Co., New York.—The Gould electric car lighting system in operation.

Green, Tweed & Co., New York.—Palmetto packing and the Favorite reversible wrench.

Hale & Kilburn Manufacturing Co., The, Philadelphia, Pa.—Full line of car seats for all service, including both single and double reclining chairs.

Heywood Bros. & Wakefield Co., Wakefield, Mass.—Seats for street and railroad cars; also brass model showing mechanism of the Wheeler seat.

The Holland Co., Chicago.—The Dake square piston compressed air motors in operation; Martin metallic flexible joints for air, steam and liquid pipe lines, and Martin metallic flexible conduits for locomotive and tender connections.

Homestead Valve Mfg. Co., Pittsburg, Pa.—Homestead valves and the Homestead steel tie and rail coupler.

William A. Huff Mfg. Co., Newark, N. J.—Demonstration of automatic car axle oiler.

Hunt-Spiller Mfg. Corporation, Boston, Mass.—H. S. gun-iron castings for locomotives, such as eccentrics, eccentric-straps, cylinder bushings, packings, etc.

Illinois Malleable Iron Co., Chicago.—Model of the Bruyn automatic swinging smoke-jack.

Independent Pneumatic Tool Co., Chicago.—Pneumatic tools and appliances, including drills, hammers, air turbines, flue rollers, etc.

International Correspondence Schools, Scranton, Pa.—Air-brake instruction car.

Jenkins Brothers, New York.—Complete line of iron and brass valves; also packings and rubber specialties.

Johns-Manville, H. W., Company, New York.—Asbestos and magnesia boiler lagging and packing; drain-pipe coverings; smoke-jacks, fireproof lumber; roofing; Vulcabeston; Noark enclosed fuse levices; electrobestos conduits and moulded insulating "Monderite."

Johnson & Johnson, New Brunswick, N. J.—Equipments for first aid to the injured; specially designed for railroad use. The booth is made up exclusively of the products of the company, including a 5-ft. bee-hive made of absorbent cotton coils.

Philip S. Justice & Co., Philadelphia, Pa.—Reliance hydraulic jacks and Justice spring power hammers.

Keystone Drop Forge Works, Philadelphia, Pa.—Drop forgings for car and locomotive work, including Keystone connecting links, safety shackle hooks and crocodile wrenches.

Landis Machine Co., Waynesboro, Pa.—Bolt threading and nut tapping machines; also samples of work.

Landis Tool Co., Waynesboro, Pa.—No. 16, plain crank grinding machine and a No. 3 universal grinding machine; also samples of work.

Lawson Car Co., New York.—100,000-lbs. capacity Lawson pneumatic dump-car.

Lindenthal, G., New York.—Rocker side bearings for freight and tender trucks; sample of full-sized truck equipped with the device.

McConway & Torley Co., Pittsburg, Pa.—Janney freight couplers; Kelso freight couplers; Pitt freight couplers; Kelso tender couplers; Kelso pilot couplers; Janney passenger car couplers, and Buhoup 3-stem coupler, with working model showing operation on curves.

McCord & Co., Chicago.—Gibraltar bumping posts; McCord journal boxes; draft gear; spring dampeners; McCanna force-feed lubricators and McKim gaskets.

Mason Regulator Co., Boston, Mass.—Full size models of the Mason locomotive reducing valve and Mason regulator.

Metal Plated Car & Lumber Co., New York.—Full size model of car window equipped with the Brown metallic window strip. Sections showing application.

Michigan Lubricator Co., Detroit, Mich.—Triple sight-feed lubricator with automatic safety device to prevent injury from blowing out of glasses; also a new glass may be put in and filled with water without closing throttle or interfering with any of the other feeds; new bull's-eye triple feed lubricator.

Midland Railway Supply Co., Chicago.—Perry roller side-bearings for railroad cars, showing condition after two years of service.

National Car Coupler Co., Chicago.—Working model showing National passenger platforms and platform buffers, National centering yoke and the improved National passenger coupler No. 6; also Hinson emergency knuckle and draft-gear.

National Lock Washer Co., Newark, N. J.—Car curtains; curtain fixtures; sash locks; sash balances and balanced car curtains; also nut locks.

National Malleable Castings Co., Cleveland, Ohio.—Pneumatically operated coupler; draft-gear attachments, and malleable castings; also a radial draft-gear demonstration.

New Jersey Tube Co., Newark, N. J.—Patent spirally corrugated boiler tubes.

Norton Grinding Machine Co., Worcester, Mass.—Samples of work, such as piston rods, crank pins, valve stems, etc., done on a grinding machine especially designed for railroad work.

Old Dominion Iron & Nails Works, Richmond, Va.—Samples of staybolt iron and iron cut nails, samples of test pieces, etc.; also a vibratory testing machine in operation.

Oliver Machinery Co., Grand Rapids, Mich.—Wood-working machinery of all kinds, including universal saws, band saws, hand joiners, wood face and gap lathes, disk sanders, and wood trimmers.

Pantasote Co., New York.—Pantasote car curtains; Forsyth patent curtain fixtures and car curtain and seat fabrics.

Penn Steel Casting & Machine Co., Chester, Pa.—Specimen open-hearth steel castings, including driving wheel centers, locomotive frames, headers for water-tube boilers and superheaters.

The Pepple Brake Co., Hillsboro, Tex.—Working model of the Pepple brake system.

Pyle-National Electric Headlight Co., Chicago.—Electric headlights for locomotives; turbine engine and electric generator.

Safety Car Heating & Lighting Co., New York.—"Standard" system of steam heating. Models showing the system as applied to passenger cars; also various parts of the apparatus cut out to show construction. Safety steam coupling; new passenger car ventilator in operation. This company is also exhibiting in the lobby of the Oriental Hotel its new mantel system for burning Pintsch gas.

Sauvage Safety Brake Co., New York.—Sauvage air-brake system in operation.

Schoen Steel Wheel Co., Pittsburg, Pa.—Pressed and rolled steel wheels, showing the various stages of manufacture.

Sherwin-Williams Co., Cleveland, Ohio.—Samples of paints and varnishes for railroad use; also color plates.

Shelby Steel Tube Co., Pittsburg, Pa.—Seamless steel tubing for locomotive flues.

Sight-Feed Oil Pump Co., Milwaukee, Wis.—Locomotive sight-feed oil pumps.

Spiral Journal Bearing Co., New York.—Spiral car journal bearings.

Sprague Electric Co., New York.—Sprague electric trolley hoist. Also steel armor hose for compressed air or steam.

Standard Car Journal Lubricator Co., New York.—Demonstration of the Standard automatic car journal lubricator.

Standard Coupler Co., New York.—Sessions-Standard friction draft gear; Standard steel platform and Standard couplers. This company also exhibits a model of a testing machine for the purpose of showing the relative values of the yielding resistance of friction and spring gears.

Standard Paint Co., New York.—Model of the Pennsylvania R. R. roundhouse covered with Ruberoid roofing. Ruberoid roofing for railroad cars and locomotive cabs; Giant insulating papers; P. & B. and S. P. C. insulation, and Ruberoid permanent colored roofings. The exhibition pavilion is covered with Ruberoid colored roofing, and has a cupola covered with Ruberoid shingles.

Standard Pressed Steel Co., Philadelphia, Pa.—Standard pressed steel shaft hangers.

Standard Steel Works, Philadelphia, Pa.—Solid rolled steel wheels; steel-tired wheels; steel tires and springs.

Star Brass Mfg. Co., Boston, Mass.—Steam gages, pop safety valves, lubricators, renewable seat and disk globe valves, angle valves, blow-off cocks, water gages, recording gages patent cylinder relief and vacuum valves.

Symington, The T. H., Co., Baltimore, Md.—Journal boxes; ball-bearing center plates and side bearings for railroad cars.

Stiles, A. C., New Haven, Conn.—Anti-friction metals.

Thomas-Tanty Co., New York.—Model of "auto balanced" door for street cars, railroad coaches and locomotive fireboxes.

The Transue & Williams Co., Alliance, Ohio.—Represented by A. Morris Hall, Philadelphia, Pa.—Drop forgings, including car and locomotive forgings, Buckeye track jacks, drop-forged keys and wedges.

United States Metal & Mfg. Co., New York.—The Columbia nut lock; Victor cast-steel car replacers; "Perfect" cast-steel car replacers; Gilbert automatic hose reel and the West malleable iron brake jaw. Also a track exhibit of a car equipped with the various specialties made by the company.

Universal Safety Tread Co., New York.—Safety treads for cars, etc.

Vandyck-Churchill Co., New York.—Higley Machine Co.'s cutting-off machine direct motor driven.

Victor Stoker Co., Cincinnati, Ohio.—The Victor locomotive stoker in operation, attached to a standard C. & O. engine cab. A full detailed description of this stoker was printed in the *Railroad Gazette*, June 9, 1905.

Wells Light Mfg. Co., New York.—Lights of one, three and five burners for contractors and general outside use; tire heating device and a tripod stand for use in foundries.

West Disinfecting Co., New York.—Disinfectants for all purposes and apparatus for applying the same.

Western Railway Equipment Co., St. Louis, Mo.—Western flush car door; Acme pipe clamps; Hoerr draft gear; Western sill pockets; Western bell ringer; Hoerr tie plate; brake jaws, and sills and carline pockets.

Western Tube Co., Kewanee, Ill.—Kewanee unions, elbows and T's. Also Y-valves and gate valves.

Westinghouse Automatic Air & Steam Coupler Co., St. Louis, Mo.—Tender and engine automatic air and steam coupler equipment; triple valve testing apparatus in operation. Machine for showing the operation and capacity of friction draft gear. Automatic air coupler models.

Wheel-Truing Brake Shoe Co., Detroit, Mich.—A brake shoe fitted with an abrasive for truing and dressing flat and worn wheels.

Yale & Towne Mfg. Co., New York.—Three types of chain blocks, including triplex, duplex and differential hoists. Also electric hoists and overhead trolleys. A large assortment of locks, including Yale locks, cabinet locks and padlocks. A full line of builders' and car hardware and Blount door checks.

GENERAL NEWS SECTION

Manila Electric Road.

The Manila Electric Railroad & Lighting Corporation began on April 11 to operate its electric line in the city of Manila, P. I. By July 1, it expects to have in operation about 40 miles of line, of which 35 miles are in the city and suburbs and five miles in a line to Malabon. The road was built by J. G. White & Co., of New York.

Erie Yard Telephone.

The Erie Railroad has put in a telephone line at Jersey City from the office of Yardmaster McCullough to the offices of his assistants at Jersey City, Bergen and Weehawken, a circuit of about five miles. It was installed by the Bell Telephone Company at a cost of about $4,000.

Steam Coupler with Slide Gasket and Automatic Lock.

The coupler shown in the accompanying illustrations was recently designed by the Consolidated Car-Heating Company, New York. It is made in all sizes, and interchanges with the makes now on the market. The coupler consists of a body casting, a single piece gasket, and a locking device cast on the side of the coupler. As shown in the cut, the arrangement for holding the gasket is simple and effective. The gasket slides into position and automatically locks in place, and can be readily removed when necessary. The curved lugs and hooks on the couplers are milled on automatic machines, so that all couplers are strictly interchangeable. Arrangements are made in the machines whereby these curves are milled on the correct centers, thereby securing absolute alinement of the gaskets. The automatic lock is the same as used on other styles of couplers made by the Consolidated Car-Heating Company. There are several distinctive features embodied in this locking device. The spring lever at all times exerts a pressure on the wing of the coupler tending to hold the gaskets together even when swinging around sharp curves. The locks are operative even when used with a coupler of another make. The locks also provide for automatic uncoupling in the event of the train parting. A model rack has been designed to show the couplers in operation. Special attention is drawn to this demonstration of the advantages of the locking device described above, at the Consolidated Car-Heating Company's exhibit.

The Consolidated Car-Heating Company's New Steam Heat Coupler.

Chicago Subway.

President A. G. Wheeler, of the Chicago underground railroads, says that by the first of September the lines will be open for business and will have connections to the principal freight houses of the city. He says that the company is already taking materials to new buildings and carrying away excavated earth from them, the aggregate tonnage being 6,000 tons a day. The progress on the tunnels during the last two months has been rapid, 60,000 cu. yds. having been taken out. While the tunnel itself is thus progressing, some of the chief promoters of the enterprise are being tried for fraud in securing the right to the use of the streets.

Large Expenditure by the Erie for Shop Improvement.

Since the publication of the Erie's expenditures in our last issue we have received authentic information in regard to the same as follows: The company has authorized the expenditure of upwards of $1,250,000 for new tools and shop improvements at various points on its system. About $470,000 of this amount will be expended for machine tools, electric cranes and motors. The capacity of the machine shop at Hornellsville will be increased and a new power plant will be built. The improvements include new 95-ft. roundhouses at Bradford, Pa.; Kent, Ohio; Marion, Ohio, and Hammond, Ind., and also the extension of the old roundhouses to 95 ft. Practically all of the machine tools have already been ordered. The following gives a list of the different shops and the amount of money which it is proposed to expend at each:

Dunmore ...	$33.085.00	Buffalo	$76,120.00
Bergen	10,000.00	Meadville ...	120,229.00
Port Jervis..	45,331.00	Cleveland ...	89,550.00
Elmira	1,000.00	Kent	53,240.00
Rochester ..	7,260.00	Galion	81,475.00
Bradford ...	28,000.00	Marion	71,510.00
Salamanca ..	36.750.00	Hammond ..	71,510.00
Susquehanna.	24,200.00	Huntington .	99,790.00
Hornellsville.	385,925.00	Stroudsburg..	15,025.00

Lake Commerce Through Sault Ste. Marie Canals.

The freight traffic passing through the canals at Sault Ste. Marie, Mich., and Sault Ste. Marie, Ont., during the season of 1904 was 31,546,106 net tons, a decrease of 9 per cent., or 3,128,331 tons, from the preceding year, due principally to the strike of the Masters and Pilots' Association. The total ton-miles for both canals were 26,608,815,636; the freight carried was valued at $334,502,-686, and the total amount paid for its transportation was $21,552,894. The average distance carried was 844 miles and the average cost per ton-mile was $^{81}/_{100}$ of a mill, the average cost per ton being 68 cents. The eastbound traffic was 24,203,902 net tons and the westbound traffic 7,332,204 net tons, or less than one-third as much. There were 16,120 vessel passages through the two canals. The traffic averaged over 5,000,000 tons per month during the months of July, August, September, October and November against 32 tons in April and 970,865 tons in December. In 1899 only 126 vessels between 300 and 400 ft. long and 41 vessels between 400 and 500 ft. long passed through the canals. In 1904, there were 102 vessels between 300 and 400 ft. long, with 38-ft. to 50-ft. beam; 118 vessels between 400 and 500 ft. long, with 45-ft. to 53-ft. beam, and one vessel between 500 and 600 ft. long, with 56-ft. beam. In 1894, no vessel carried more than 4,000 tons and only 18 over 3,000 tons. In the past year 154 vessels carried between 3,000 and 4,000 tons, 37 between 4,000 and 5,000 tons, 30 between 5,000 and 6,000 tons, 64 between 6,000 and 7,000 tons, 59 between 7,000 and 8,000 tons, 36 between 8,000 and 9,000 tons (an increase in this group of 17 over 1903), three between 9,000 and 10,000 tons, and one over 10,000 tons, the latter four vessels being additions during 1904. The nine new vessels put in commission during the year ranged from 245 ft. to 560 ft. long and were designed for an economical speed of 12 miles an hour, with a draft of 19 to 21 ft. Three of the four individual maximum records made during the season are held by the steamer "Augustus B. Wolvin," of the Acme Steamship Company, which carried 11,536 tons in a single cargo, had total cargoes of 177,729 tons during the season, and a record for the season of 156,410,487 mile tons. The steamer "Huronic" holds the record for number of miles run, with a total of 33,516 miles. The maximum traffic through the canals for a single day was on September 6, when 287,399 tons of freight passed through on 99 vessels which had an aggregate registered tonnage of 180,325 tons. The American canal records show that vessels necessarily spent 17,057 hours in the canal, or an average of one hour and 34 minutes. Lake Superior commerce has grown from 1,203,358 tons in the ten years ended 1864, during which period there was an average yearly increase of 44 per cent., to 253,002,697 tons during the decade ended 1904, during which time there

was an average yearly increase in the amount of freight carried of 12 per cent.

Waverly Transfer.

The Pennsylvania Railroad has begun making improvements at its new freight yard at Waverly, N. J. The transfer platforms and sheds are to be greatly enlarged and a 70-ft. turntable is to be built. All the freight trains that go to the Greenville terminus on New York Bay are made up at Waverly and about 45,000 cars are handled monthly.

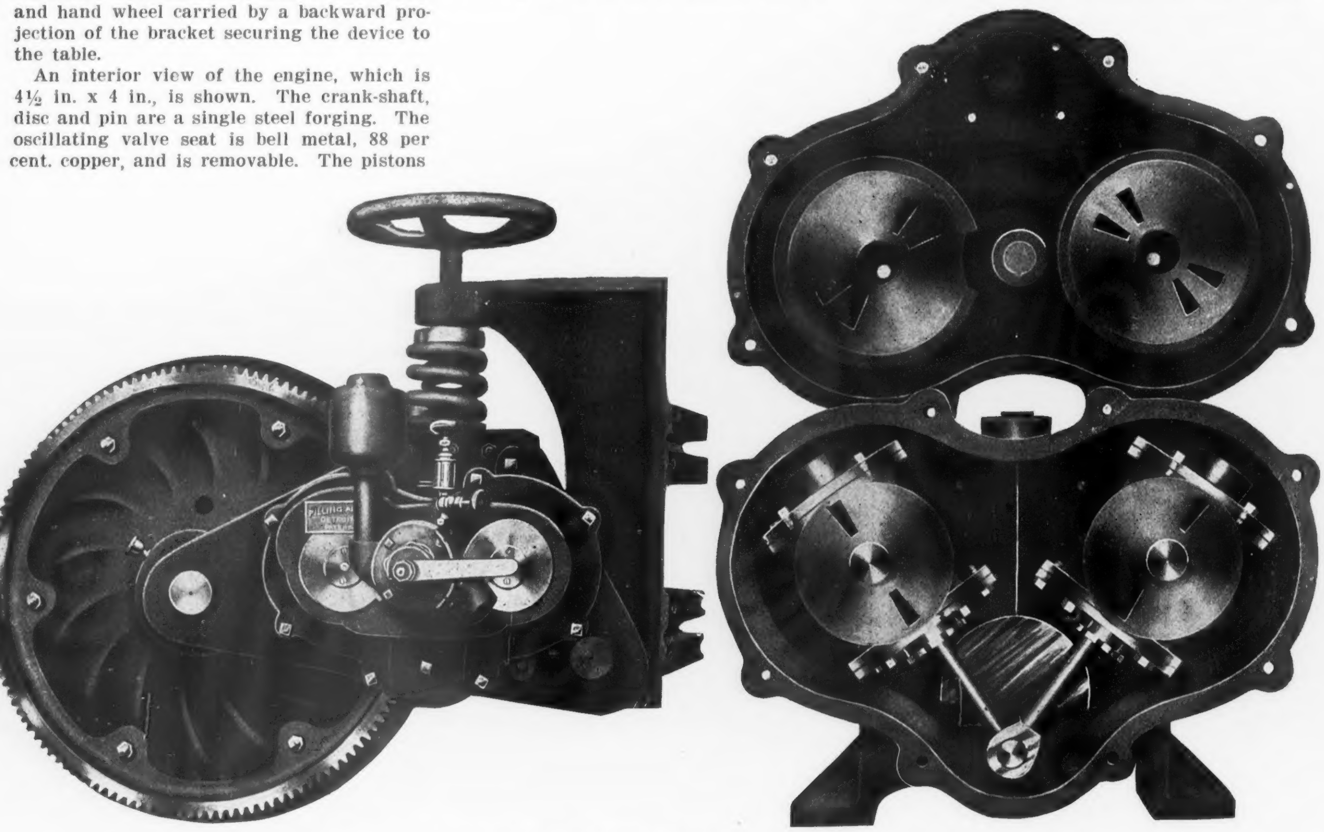
Pilling Pneumatic Turntable Device.

A design of pneumatic turntable device recently patented is illustrated herewith. The frame is formed of ⅞-in. plate there being two plates spaced 8 in. apart. A cast-steel spring seat is bolted to them at the top on which is a standard M. C. B. draft spring for varying the adhesion of the device. This variation is obtained by means of a screw and hand wheel carried by a backward projection of the bracket securing the device to the table.

An interior view of the engine, which is 4½ in. x 4 in., is shown. The crank-shaft, disc and pin are a single steel forging. The oscillating valve seat is bell metal, 88 per cent. copper, and is removable. The pistons are concave-convex, permitting a deep stuffing box, which is metallic packed. The engine runs in oil, requiring a pint twice a week. All bearings of the entire device are bronze bushed. The traction wheel is a 33-in. car wheel and the gear wheel is of cast-steel, cut. The gear ratio is 1 to 16.

The air passages and ports of the engine were designed to avoid trouble from frost in extremely cold weather. The device has been in use in Canada in 20 and 30 deg. below zero and no difficulty was experienced. Provision is made for reheating the air. A piece of pipe 6 in. in diameter and 18 in. long is placed in the supply line, and over it a hood with a sliding door in the bottom. A common signal-oil torch is placed in the hood under the pipe, and it is claimed a saving of 40 per cent. is obtained.

The device can be attached to a table in two hours without interfering with its movements meanwhile. The motor is controlled by a lever on the table which can be moved by hand or foot, the speed of the table also being governed by the pressure on this lever. The maximum time for a complete revolution of the table is approximately one minute, with a line pressure of 50 lbs. Provision is made for using air either from a shop plant or from the locomotive. For outgoing engines this furnishes a means for testing the air. The device is in use on the Canadian Pacific, Toledo & Ohio Central, Hocking Valley, Kanawha & Michigan and Big Four railroads. It was invented by J. L. Pilling and is made by the Pilling Air Engine Co., Detroit, Mich.



The Pilling Air-Engine for Turntables.

Manufacturing and Business.

The Landis Tool Co., of Waynesboro, Pa., is putting up an addition to its foundry 28 ft. x 60 ft.

The works of the Landis Machine Co. at Waynesboro, Pa., are to be enlarged. A new building 115 ft. x 80 ft. will be put up.

The Grand Trunk will begin work during the present month on a new grain elevator at Midland, Ont., which will have a capacity of 1,000,000 bushels and is to cost about $500,000.

W. P. Culver, formerly with the Cleveland Motor Car Co., is now the eastern representative of the Diamond Chain & Mfg. Co., of Indianapolis, Ind., and will have headquarters in New York.

The Seaboard Car Company, representing Philadelphia interests, is now acquiring the plant of the Georgia Car & Manufacturing Company at Savannah, and will shortly put the plant in operation.

The Middletown Car Works at Middletown, Pa., will be enlarged. The company at present is filling large orders for steel frame cars for the Japanese Government; also for South American railroads.

The Block-Pollak Iron Company has established a branch office at 1610 Chemical Building, St. Louis, Mo. The Chicago office of the company has been changed from the Marquette Building to the First National Bank Building.

A large steel plant is to be built at Sebring, near Youngstown, Ohio, by the Keystone Steel Co., recently chartered in West Virginia. Richard Jones, of Parkersburg, W. Va., and others of McKeesport, Pa., are interested in this company.

The Arnold Company, Chicago, which was awarded the contract for the complete light, heat, power and compressed air equipment for the new Missouri Pacific shops at Sedalia, Mo., has begun the installation of same, all material having been bought.

A contract is reported let to the Mead Company, of Cleveland, Ohio, for furnishing two steel hoisting towers and a steel bridge, for August delivery, at the blast furnace and coal and ore docks to be built at Port Arthur, Ont., in connection with the Canadian Northern improvements.

The Electro-Dynamic Co., Bayonne, N. J., will show its inter-pole variable speed motors in operation at its exhibit on the veranda of the Manhattan Beach Hotel during the Master Mechanics and Master Car Builders convention. These motors are especially designed for operating machine tools. The important features of these motors are sparkless commutation, under any load or overload reversibility, compactness, simplicity and perfect control of speed.

The Kalamazoo Railway Supply Co., Kalamazoo, Mich., has added Mr. John McKinnon, of Chicago, to its force of traveling salesmen. He has been a manufacturer and seller of railroad supplies for 20 years, and is well and favorably known to railroad officers throughout the country. Mr. McKinnon was for many years salesman for the

Morden Frog & Crossing Works, and for the last eight years has been with the Buda Foundry & Mfg. Co. in charge of the sales department.

Announcement has been made that the Atchison, Topeka & Santa Fe will build a large dyke on the east bank of the South Canadian river near Purcell, Ind. T., where the high waters annually damage property and destroy large areas of farming lands. The Santa Fe track at that place is being raised 5 ft. The work will cost about $200,000.

The Chicago, Rock Island & Pacific last week took a party of retail coal dealers from Minnesota, Wisconsin, Iowa and other northwestern states to the coal mines situated on the Rock Island lines in Illinois, with a view to showing them the advantage of buying coal in that region. Officers of the Rock Island believe that the people of the northwest have been paying too high prices for their bituminous coal and propose to give them an opportunity to get their supplies at lower rates. The Consolidated Indiana Coal Co., recently incorporated, with a capital stock of $4,000,000, has bought 10,500 acres of coal lands in Sullivan County, Illinois, from which coal is already being taken out at the rate of 10,000 tons per day. The Rock Island Coal Co. has mines in Illinois and in the Indian Territory. The Rock Island road proposes to put this coal in the northwestern markets at favorable rates to the consumer.

J. W. Duntley, President of the Chicago Pneumatic Tool Company, recently returned from a six weeks trip to Europe, bringing with him orders for 3,400 tools, amounting to over $300,000. The Chicago Company has bought the factory and business of E. G. Eckstein, Berlin, Germany, and of The Lencke Company, St. Petersburg, Russia, to meet the growing demand of the Continental countries for pneumatic tools. There is also a gratifying demand for the electric drills made by the Chicago Company. The English courts on May 17 rendered the final adjudication of the patent litigation instituted by the English company, which decision sustains all of the company's claims, 52 in number, covering pneumatic hammers. This leaves the English company in a strong position with reference to its patents. Its plant located at Fraserburgh, Scotland, is now in full operation. The American business is also reported to be showing a satisfactory increase in volume, and all factories, both American and foreign, are working overtime.

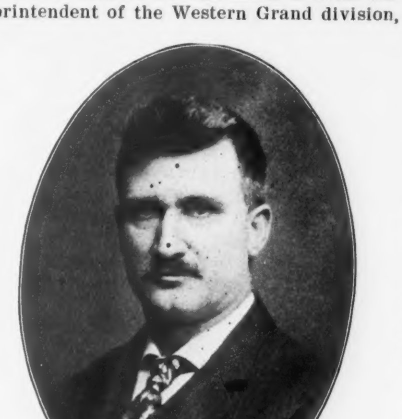
The Independent Pneumatic Tool Company, Chicago, has acquired the Aurora Automatic Machinery Company, of Aurora, Ill., builder of Thor piston air drills, pneumatic riveting, chipping, calking and beading hammers, piston air motor hoists, pneumatic saws and other air appliances. The general offices of the Independent Company are in the First National Bank Building, Chicago, and the eastern offices are at 170 Broadway, New York. The officers are: Jas. B. Brady, President; W. O. Jacquette, First Vice-President; John D. Hurley, Second Vice-President; A. B. Holmes, Secretary; C. E. Erikson, Treasurer; A. Levedahl, Mechanical Superintendent. The Board of Directors includes, beside the first five of the officers, John P. Hopkins, Simon Florsheim, John M. Glenn, J. J. McCarthy and Louis B. Dailey. Mr. Florsheim is chairman of the board. The works of the company at Aurora, Ill., are equipped with the latest improved machinery, and have a capacity of about 1,000 pneumatic tools a month. The Thor tools are used in many large plants in all parts of the world, and are claimed to be giving entire satisfaction.

PERSONAL.

—Mr. Edward L. Douglass, recently appointed General Manager of the Gainesville Midland, was for five years Superintendent of a street railroad and lighting company in Tampa, Fla., and later Chief Clerk to the Chief Engineer of the Plant System for five years. For two years after leaving this posi-

tion he was in the employ of the Savannah Trust Co. and, at the same time, Secretary and Treasurer of the Macon Railway & Light Co. Since August last, he has been Secretary, Treasurer and Auditor of the Gainesville Midland, which position he now leaves to become General Manager.

—Mr. James E. Hurley, who has been appointed General Manager of the Atchison, Topeka & Santa Fe System, has been an officer of the company about 12 years. From Assistant Superintendent of the Missouri division he was promoted to the Chicago division as Assistant Superintendent, and in June, 1894, was made Superintendent of the New Mexico division. He was soon made Superintendent of the consolidated New Mexico and Rio Grande divisions, and in 1901 was appointed Acting General Superintendent of the lines west of Albuquerque. In a few months he was made General Superintendent of the Western Grand division,



and in 1902 was appointed General Superintendent of the Eastern Grand division, from which position he is now promoted to be General Manager. Mr. Hurley was born at Wapello, Iowa, in 1860. After graduating at the high school at that place, he evidently planned to be a teacher, for he went to the Bloomfield Normal School at Bloomfield, Iowa, for three years. A little teaching satisfied him, however, and he began railroad work as a trackman on the Santa Fe. He soon got into the freight department, then learned telegraphy and became operator and relief agent. His next position was Chief Clerk and Cashier and later he was Agent, Chief Clerk to the General Superintendent, Trainmaster and Assistant Superintendent. He was Assistant Superintendent of the Chicago division at the time of the World's Fair.

—Mr. H. E. Hale, appointed Engineer Maintenance of Way of the main line system of the Baltimore & Ohio, is a native of Minnesota and is 30 years old. He graduated at Lehigh University, working during several summer vacations in the construction and maintenance of way departments of the Pennsylvania as rod man. He continued this work after he left college and in 1901 became Supervisor of Signals at Camden, N. J. In March, 1902, he went to the Baltimore & Ohio as Assistant Engineer at Baltimore, and a few months later he was made Division Engineer at Philadelphia. On Dec. 15, 1903, he was promoted to be Superintendent at Butler, Pa., and on Sept. 1, 1904, was transferred to be Division Engineer of the Baltimore division. On June 1, he left this position to become Engineer Maintenance of Way of the main line system, with headquarters at Baltimore.

—Mr. Robert H. Bowron, the new General Manager of the Cincinnati, Hamilton & Day-

ton, and the Chicago, Cincinnati & Louisville, was born at Stockton, England, in 1858, and graduated from Gainford Academy in 1874. He began railroad work in America in 1877 as an operator on the Tennessee Coal & Iron Co.'s lines, and later was in the railroad supply business. From 1884 to 1887 he was Chief Clerk to Division Superintendents on the Alabama Great Southern, and the Mobile & Ohio. In February, 1887, he was made Superintendent of the Chattanooga Union Railway, which position he held until 1892, when he worked on preliminary surveys for a projected line. In 1894, he became Chief Clerk to the General Superintendent of the Montana Central; in 1895, Trainmaster, and in 1896, Superintendent of the Montana division of the Great Northern. During the next year he was transferred to the Superintendency of the Wilmar and Breckinridge divisions, and in 1898 to the Cascade division. In October, 1899, he became Superintendent of the St. Louis Southwestern, and in March, 1900, was made Vice-President and General Superintendent of the St. Louis Southwestern of Texas. In 1904, he was appointed Superintendent of the First division of the Denver & Rio Grande,

and in December last came to the Cincinnati, Hamilton & Dayton as Superintendent of the Northern and Southern divisions. From this position, he is promoted directly to be General Manager.

—Mr. George W. Cross, for several years General Southwestern Passenger Agent for the Chicago, Milwaukee & St. Paul, died recently in Kansas City.

—Mr. C. H. Ewing, the new Engineer of Maintenance of Way of the Philadelphia & Reading, entered the service of that road on Aug. 1, 1883, as a rodman on construction work and was shortly advanced to transitman and Assistant Engineer. In 1889, he was appointed Assistant Supervisor of Track on the New York branch, and in 1890, Supervisor of the Bethlehem branch, being later transferred to Atlantic City and Lebanon, Pa. On Nov. 1, 1892, he was appointed Division Engineer of the New England division and held this position until the Philadelphia & Reading relinquished its New England properties, when he was appointed Chief Engineer of what is now the Central New England. This position he held until Aug. 1, 1902, when he was appointed Division Engineer of the Reading and Lebanon divisions of the Philadelphia & Reading at Reading. From this position he was on June 1 promoted to be Engineer of Maintenance of Way of the Reading System.

—Mr. R. K. Smith, who, under date of June 10, was appointed General Manager

of the Detroit, Toledo & Ironton (the former Detroit Southern), was born at Staunton, Va., Feb. 22, 1869. He was educated at St. James Military Academy in Macon, Mo. In 1887, he entered railroad service on the Union Pacific. In July, 1888, he went to the Wabash as operator. For a year from February, 1889, he was agent of the Wabash at Macon, Mo. On Feb. 1, 1890, he went to the Chicago, Burlington & Quincy as Contracting Freight Agent at Kansas City, and on July 1, 1894, he was made General Agent at Atchison and later General Agent at Leavenworth. On Nov. 1, 1899, he was made Assistant Superintendent at St. Joseph. In October, 1902, he left the Burlington to go to the Iron Mountain as Superintendent of the Missouri division. In June, 1903, he was also made Superintendent of the Illinois Division, and was Superintendent of the Missouri and Illinois divisions until his present appointment as General Manager of the Detroit, Toledo & Ironton.

—Mr. Robert E. L. Bunch, who has been appointed Traffic Manager of the Atlantic & North Carolina and the Asheville & Craggy Mountain, was born Aug. 31, 1869, near Raleigh, N. C., and received a common school education. He began railroad work in 1887 as mail clerk in the office of the Division Freight and Passenger Agent of the Richmond & Danville at Raleigh, N. C. Later, he became Chief Clerk to the Division Freight Agent, Chief Clerk to the Assistant General Passenger Agent, and Second Clerk in the General Passenger Agent's office of this road and of its successor, the Southern Railway. In 1895, he became Chief Clerk of the General Passenger department of the Southern at Washington. In December, 1900, he was made Assistant General Passenger Agent of the Southern at St. Louis, in charge of the passenger department west of Pittsburg and Buffalo, with jurisdiction over the St. Louis-Louisville lines, but declined that position to become, on Jan. 1, 1901, General Passenger Agent of the Seaboard Air Line. He held this position until May 2, 1902, when he retired to private life in Washington, during which time he had an opportunity to recover his health, which had been seriously impaired by an attack of typhoid fever. He goes back to railroad service as Traffic Manager of the two roads first mentioned.

ELECTIONS AND APPOINTMENTS.

Arkansas Southeastern.—G. F. Blumenkamp, formerly General Attorney, has been appointed General Freight and Passenger Agent, with office at St. Louis, Mo.

Atchison, Topeka & Santa Fe.—Thomas R. Morrow has been appointed Solicitor for Missouri and Iowa, with office at Kansas City, Mo.

Atlantic Coast Line.—J. T. King has been appointed Car Accountant, with office at Wilmington, N. C., succeeding William Flannagan.

Baltimore & Ohio.—William McGowan, Assistant Auditor of Merchandise Receipts; C. C. Glessner, Assistant Auditor of Coal and Coke Receipts, and C. H. Poumairat, Assistant Auditor of Passenger Receipts, have each been appointed Auditor of their respective departments.

Buffalo, Attica & Arcade.—E. A. Niel, Traffic Manager of the Buffalo & Susquehanna, has been appointed Traffic Manager.

California Northwestern.—James Agler, formerly Manager of the Southern Pacific, has been appointed General Manager of the California Northwestern and the North Shore, with headquarters at San Francisco, succeeding J. L. Frazier, resigned.

Chesapeake & Ohio.—F. I. Cabell has been appointed Engineer Maintenance of Way, succeeding E. W. Scarborough, with headquarters at Richmond, Va.

Chicago & North-Western.—E. E. Betts has been appointed Car Service Agent, with office at Chicago, Ill., succeeding Walter P. Marsh.

Chicago, Cincinnati & Louisville.—F. D. Hodgson has been appointed Acting Auditor, succeeding J. F. Shepherd.

A. L. Moler, Master Mechanic at Peru, Ind., has resigned.

Chicago, Rock Island & El Paso.—C. S. Tewksbury, Freight Claim Agent of the Chicago, Rock Island & Pacific, has been appointed Freight Claim Agent, with office at Chicago, Ill., succeeding G. C. Arnold.

Chicago, St. Paul, Minneapolis & Omaha.—Charles F. Shanley has been appointed Freight Claim Agent in charge of loss and damage claims, with office at St. Paul, Minn. The position of Assistant Claim Agent, previously held by Mr. Shanley, has been abolished.

Corvallis & Eastern.—J. C. Mayo has been appointed General Freight and Passenger Agent, with office at Albany, Ore.

Denver & Rio Grande.—Herbert T. Herr, Assistant to Vice-President C. H. Schlacks, has been appointed Acting General Superintendent, succeeding William Coughlin, resigned.

Denver, Enid & Gulf.—W. G. Bartlett has been appointed Purchasing Agent, with office at St. Louis, Mo.

Detroit, Toledo & Ironton.—R. K. Smith, late Superintendent on the St. Louis, Iron Mountain & Southern, has been appointed General Manager, with headquarters at Detroit, Mich.

Dublin & Southwestern.—W. J. Kessley has been appointed General Manager, with headquarters at Dublin, Ga., succeeding C. E. Rentz.

El Paso & Southwestern.—J. L. Campbell has been appointed Engineer Maintenance of Way and Thomas Paxton, Superintendent of Motive Power of the El Paso & Southwestern and the El Paso-Northeastern System. E. Dawson has been appointed Master Mechanic of the El Paso-Northeastern System.

El Paso North-eastern System.—See El Paso & Southwestern.

Georgetown & Western.—P. A. Willcox has been appointed Receiver, succeeding F. S. Farr, Receiver and General Manager. Mr. Farr continues to be General Manager.

Great Northern.—Charles Dunham, Signal Engineer of the Illinois Central, has been appointed Signal Engineer.

A new division called the Minot division has been created, extending from Devil's Lake, N. Dak., west to Williston, 239 miles. J. M. Davis, previously Superintendent of the Dakota division, has been appointed Superintendent of the new division, and F. W. Allen, previously Roadmaster of the Cascade division, Assistant Superintendent. Mr. Davis was formerly Superintendent and Mr. Allen a Division Engineer on the Erie. Macy Nicholson has been appointed Superintendent of the Dakota division, with headquarters at Grand Forks, N. Dak., succeeding Mr. Davis.

Archibald Gray, Assistant General Freight Agent, has also been appointed Assistant General Passenger Agent, with headquarters at Butte, Mont.

Illinois Central.—Charles Dunham, Signal Engineer, has resigned. See Great Northern.

Indiana Harbor.—F. G. Hopper has been appointed General Freight Agent, with office at Chicago, Ill., succeeding F. W. Fairbairn.

Lake Shore & Michigan Southern.—N. D. Dougman, Local Attorney at Fort Wayne, Ind., for the Lake Shore & Michigan Southern and the New York, Chicago & St. Louis, has been appointed Assistant General Counsel, with headquarters at Cleveland.

Leavenworth, Kansas & Western.—J. O. Brinkerhoff has been appointed Superintendent, with headquarters at Kansas City, Mo.

Licking River.—R. H. Lanyon has been elected President, with office at Chicago, Ill.; Frederick Pischel, Secretary and F. J. Pischel, Treasurer, both with offices at Farmers, Ky. They succeed L. E. Carlton, President; J. W. M. Stuart, Secretary, and Calvin H. Hill, Treasurer.

Louisiana Railway & Navigation.—D. C. Fenstermaker has been appointed Chief Engineer.

Louisville & Nashville.—F. A. Beckert, General Foreman of the Riverside shops, has been appointed Assistant Master Mechanic, with headquarters at Boyle's, Ala.

Macon, Dublin & Savannah.—W. F. Combs has been appointed Master Mechanic with headquarters at Macon, Ga., succeeding F. R. Cooper, resigned to become Master Mechanic on the Lehigh Valley.

Maine Central.—F. E. Sanborn has been appointed Superintendent of the Portland division, with headquarters at Portland, succeeding E. A. Hall.

Manistique, Marquette & Northern.—E. E. Coombs has been appointed Auditor, with office at Manistique, Mich., succeeding F. E. Wilkin.

Milltown Air Line.—The officers of this company are: A. J. Stevens, President; A. De Armon, General Manager, and N. E. Whitehurst, Jr., General Freight and Passenger Agent.

Missouri Pacific.—F. Neher, instead of F. Neper, as recently reported, has been appointed Principal Assistant Engineer of the Missouri Pacific and the St. Louis, Iron Mountain & Southern.

W. T. Schultz has been appointed General Tie and Timber Inspector, succeeding J. O. Potts, promoted.

Mobile, Jackson & Kansas City.—L. L. Lawrence has been appointed Manager of the industrial and immigration departments, with office at Laurel, Miss.

National of Mexico.—George F. Jackson having resigned as Assistant General Freight and Passenger Agent at Monterey, that office has been abolished.

H. L. Newton, Traveling Conductor, has been appointed Superintendent of Terminals at the City of Mexico, succeeding J. W. Dean.

Nevada County Narrow Gage.—Samuel Granger has been elected Vice-President and H. C. Phillips appointed Auditor, both with headquarters at Grass Valley, Cal., succeeding Peter Johnston, previously Vice-President and Auditor, resigned.

New Orleans Terminal.—F. G. Jonah, formerly Chief Engineer of the St. Louis, Brownsville & Mexico, has been appointed Terminal Engineer, with office at New Orleans.

Norfolk & Southern.—C. W. Van Voorhis has been elected Treasurer, and A. H. Larkin, Secretary, both with offices at New York.

Norfolk & Western.—H. L. Daw, Division Freight Agent, has been appointed Assistant General Freight Agent, with office at Columbus, Ohio.

North Shore.—F. B. Latham has been appointed Assistant General Freight and Passenger Agent, with office at San Francisco, Cal., succeeding G. W. Heintz, resigned.

See California Northwestern.

Oregon Railroad & Navigation.—Thomas Walsh, Assistant Superintendent of the Mountain division, has been appointed Superintendent of the Washington division with headquarters at Tekoa, Wash., succeeding D. W. Campbell, promoted. Mr. Walsh is succeeded as Assistant Superintendent, with headquarters at La Grande, Oregon, by William Connolly, Assistant Superintendent of the Washington division.

Pacific & Idaho Northern.—J. J. Harris, of the engineering department of the Denver & Rio Grande, has been appointed Chief Engineer in charge of new construction.

Pacific Coast Company.—J. C. Ford has been elected Vice-President, with office at Seattle, Wash., succeeding Edwin Goodall, Vice-President and General Manager. J. W. Smith has been appointed Acting General Auditor, with office at Seattle, succeeding F. C. Ambridge, previously General Auditor.

Pecos Valley Lines.—J. E. Hurley, General Manager of the Atchison, Topeka & Santa Fe, has been elected President of the Pecos Valley Lines and also of the Southern Kansas Railway of Texas, succeeding H. U. Mudge.

Philadelphia & Reading.—F. M. Flack, Division Engineer of the Shamokin division, has been transferred to the Reading and Lebanon divisions, with headquarters at Reading. He is succeeded by J. W. De-Moyer, who has been Supervisor at Pottsville. Mr. De Moyer's headquarters are at Tamaqua, Pa.

Pittsburg, Summerville & Clarion.—L. F. Dorr has been appointed Auditor and J. W. McMartin, Principal Engineer, both with office at Clarion, Pa.

Pullman Company.—O. P. Powell, Assistant Purchasing Agent, has been appointed Assistant General Manager. He is succeeded by H. P. Walden. Both have headquarters at Chicago.

Quebec Southern.—The office of R. A. Trudeau, Superintendent, has been moved from St. Hyacinthe, Que., to Montreal.

Rio Grande, Sierra Madre & Pacific.—C. T. Carson has been appointed Assistant Auditor with office at El Paso, Tex.

St. Louis, Iron Mountain & Southern.—J. W. Daniels, Trainmaster, has been appointed Superintendent of the Missouri Division, succeeding R. K. Smith, resigned. He will have jurisdiction in the transportation, maintenance of way and machinery departments, and will also have supervision of the transportation service of the company over the St. Louis Southwestern between Dexter and Illmo, Mo.

San Antonio & Aransas Pass.—J. C. Mangham has been appointed General Freight Agent with office at San Antonio, Tex.

San Pedro, Los Angeles & Salt Lake.—The office of W. A. Clark, President, has been moved from Butte, Mont., to New York. E. B. Crandall has been appointed General Baggage Agent with office at Los Angeles, Cal.

South Buffalo.—George L. Reis has resigned as Vice-President, General Manager and Director. C. H. McCullough, Jr., has been elected Vice-President and Director and will assume the duties of General Manager until that office is filled.

A. K. Hamilton has been appointed Chief Engineer with office at Buffalo, N. Y., succeeding C. C. Conkling.

Southern.—Gray W. Johnston has been appointed Electrical Engineer with office at Washington, D. C.

Southern Kansas Railway of Texas.—See Pecos Valley Lines.

Southern Pacific.—H. B. Titcomb, Assistant Resident Engineer of the Sacramento division, has been appointed Resident Engineer of the San Joaquin division, with headquarters at Bakersfield, Cal., succeeding A. D'Heur.

Toledo, St. Louis & Western.—Charles E. Spencer has been elected Secretary and Treasurer, with office at New York, succeeding J. H. Seaman, resigned.

Vandalia.—R. K. Rochester, Engineer Maintenance of Way, has been appointed Principal Assistant Engineer. E. L. Shaneberger, formerly Engineer Maintenance of Way of the Peoria division, has been appointed Engineer Maintenance of Way, with headquarters at Logansport, Ind., succeeding Mr. Rochester. H. C. Johnson, formerly Assistant Engineer at Logansport, has been appointed Engineer of Maintenance of Way of the Peoria division, succeeding Mr. Shaneberger.

Wabash-Pittsburg Terminal.—J. W. Patterson, Jr., has resigned as Superintendent. He is succeeded by H. W. McMaster, Superintendent of the Wheeling & Lake Erie, whose jurisdiction is extended over the Wabash-Pittsburg Terminal to Rook, with headquarters at Canton, Ohio. C. V. Wood has been appointed Superintendent of Terminals, including the Rook yard, with headquarters at Pittsburg.

The office of Robert Blickensderfer, Manager, has been removed from Cleveland to Pittsburg.

Waterloo, Cedar Falls & Northern.—C. D. Cass, General Passenger Agent, has been appointed General Manager, succeeding L. S. Cass, President and General Manager, recently appointed Assistant to the President of the Chicago Great Western. Mr. Cass is succeeded as General Passenger Agent by J. H. Cummings. Frank McDonald has been appointed Assistant to the General Manager and the office of Assistant to the President and General Manager, formerly held by him, has been abolished.

Waukegan & Mississippi Valley.—J. Waldeck has been appointed Superintendent, with office at Waukegan, Ill., succeeding F. C. Gedge.

West Side Belt.—B. A. Worthington has been elected Vice-President and Robert Blickensderfer has been appointed Manager, both with offices at Pittsburg, Pa.

Youngstown & Southern.—John Stambaugh has been elected President, succeeding C. P. Phelps. S. J. Dill has been elected Second Vice-President and General Manager.

LOCOMOTIVE BUILDING.

The Erie, as reported in our issue of June 2, has ordered 16 simple Pacific (4-6-2) locomotives from the Rogers Works of the American Locomotive Co., for November delivery. These locomotives are to weigh 230,500 lbs., with 149,000 lbs. on drivers; cylinders, 22½ in. x 26 in.; diameter of drivers, 74 in.; straight-top boiler, with a working steam pressure of 200 lbs.; total heating surface, 4,153 sq. ft.; 336 charcoal iron tubes, 2¼ in. in diameter and 20 ft. long; Otis steel wide firebox, 108⅛ in. x 75¼ in.; grate area, 56.5 sq. ft.; tank capacity, 8,500 gallons, and coal capacity, 16 tons.

The Hocking Valley has ordered nine simple eight-wheel passenger (4-4-0) locomotives and nine simple six-wheel switching (0-6-0) locomotives from the American Locomotive Co. Three of the passenger and six of the switching locomotives are for the Hocking Valley, four passenger and three switching locomotives are for the Toledo & Ohio Central and two passenger locomotives are for the Kanawha & Michigan. The passenger locomotives will weigh 133,000 lbs., with 87,000 lbs. on the drivers; cylinders, 18 in. x 26 in.; diameter of drivers, 66 in.; extended wagon top boiler, with a working steam pressure of 180 lbs.; 295 Detroit seamless steel tubes, 2 in. in diameter and 11 ft. 7 in. long; Otis steel fire-box, 107½ in. x 39½ in. Laughridge patent; tank capacity, 5,000 gallons, and coal capacity, eight tons. The switching locomotives will weigh 131,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 50 in.; radial stayed extended wagon top boiler, with a working steam pressure of 180 lbs.; Detroit Seamless steel tubes, 2 in. in diameter and 11 ft. 1⅛ in. long; Otis steel fire-box, $98^3/_{16}$ in. x 38¾ in. Laughridge patent; tank capacity, 4,000 gallons and coal capacity, eight tons. The special equipment for all the locomotives includes: New York air-brakes, Otis steel axles, Keasbey & Mattison magnesia boiler lagging, Simplex brake beams, Major and Tower couplers, Star headlights, Ohio injectors, McCord journal boxes, Jerome piston rod packings, Hayden safety valves, Leach sanding devices, Detroit sight-feed lubricators, Railway Steel Spring Company's springs and standard driving wheel tires; with Martin steam heat equipment and cast-steel Davis counterbalanced wheel centers for passenger locomotives.

CAR BUILDING.

The United Railroads of San Francisco are reported to have ordered 50 cars for electric service.

The Government Railroads of the Argentine Republic are reported to have ordered 614 cars from the Middletown Car Works.

The Huntington & Broad Top has ordered 56 standard steel hopper cars of 100,000 lbs. capacity from the American Car & Foundry Co., for August delivery.

The Denver, Enid & Gulf has ordered 75 box cars of 60,000 lbs. capacity from the American Car & Foundry Co., for June delivery. These cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements.

The Toledo & Western (Electric) has ordered five hopper bottom gondola cars of 80,000 lbs. capacity from the American Car &

Foundry Co., for August delivery. These cars will be 36 ft. long, 9 ft. 7½ in. wide and 4 ft. 4¾ in. high, all inside measurements. The special equipment will include: Westinghouse air-brakes, Tower couplers and American Car & Foundry Co.'s wheels.

The Mexican Railway has ordered 100 box cars of 60,000 lbs. capacity from the Pullman Co., for September delivery. These cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements. The special equipment includes: Pullman brake beams, Christie brake shoes, Westinghouse air-brakes, and draft rigging, Tower couplers, Wagner flush doors, Soule dust guards, American Steel Foundry's trucks and Griffin wheels.

The El Paso & Southwestern has ordered 250 wooden hopper bottom gondola cars of 60,000 lbs. capacity from A. V. Kaiser & Co., Philadelphia, for June and July delivery. These cars weigh 26,000 lbs., and measure 25 ft. 7 in. long, 8 ft. 5½ in. wide and 4 ft. 10¾ in. high, all inside measurements. The special equipment includes: National-Hollow brake beams, Christie brake shoes, Westinghouse air-brakes and Graham draft rigging.

The Atlantic Coast Line, as reported in our issue of June 9, has ordered 1,000 ventilated box cars from the Western Steel Car & Foundry Co., and 500 ventilated box cars from the South Atlantic Car Manufacturing Co., all of 60,000 lbs. capacity, for August delivery. All cars will weigh about 34,500 lbs., and measure 36 ft. long, 8 ft. 6 in. wide and 7 ft. 5⅛ in. high, all inside measurements. The special equipment will include: Christie brake shoes, Westinghouse air-brakes, Damascus brasses, Tower couplers, National malleable door fastenings, Thornburgh draft rigging, Harrison dust guards, arch-bar trucks and Decatur wheels.

The Chicago North-Western, as reported in our issue of June 9, has ordered 500 double deck and 500 feed water stock cars and 500 furniture cars, all of 60,000 lbs. capacity, from the Pullman Co., for September and November delivery. It has also ordered 1,000 box cars of 80,000 lbs. capacity from the same company for December delivery. The stock cars will be 36 ft. long, 8 ft. 5 in. wide and 7 ft. ¾ in. high, all inside measurements. Of the furniture cars, 300 will be 40 ft. long and 200 will be 50 ft. long; all will be 8 ft. 10 in. wide and 9 ft. 1¾ in. high, all inside measurements. The box cars will be 36 ft. ½ in. long, 8 ft. 6 in. wide and 7 ft. 8¾ in. high, all inside measurements. The special equipment for all will include: Williamson & Priese bolsters and draft rigging, Westinghouse air-brakes, Chicago couplers, Congdon brake-shoes for furniture cars and Christie and Congdon brake-shoes for stock cars and box cars.

BRIDGE BUILDING.

ADA, MICH.—Bids are wanted June 24, by Arthur R. Martin, Township Clerk, for building a steel bridge and foundations over the Grand river, in Kent County.

AUSTIN, TEX.—The International & Great Northern is putting in a number of bridges along the line of its road, including a steel bridge at this place.

BEAUMONT, TEX.—The Southern Pacific is planning to build an overhead crossing or viaduct over its yards at this place, connecting the north and south ends of the city, at a cost of about $40,000.

BROOKHOLM, ONT.—Bids are wanted by William Bedwell, Reeve of Sarawak, June 23, for building a steel bridge on concrete abutments at Bayview, near Owen Sound.

CLEVELAND, OHIO.—The Baltimore & Ohio and City Engineer Carter are planning to eliminate four grade crossings and have plans ready, which call for the building of four bridges, two of which are to be built by the Wheeling & Lake Erie, one by the Baltimore & Ohio, and one by the Newburg & South Shore.

DENVER, COLO.—The Denver & Rio Grande, it is reported, is planning to replace many of its wooden bridges with stone and steel structures.

FREDERICTON, N. B.—Bids are wanted by the Department of Public Works June 19 for rebuilding the Brisby creek bridge, at Gladstone, Sunbury; the Nevers bridge at Cambridge, and the Queens & Tedley creek bridge at Brighton, Carleton.

INDIANAPOLIS, IND.—Bids will soon be asked for building a new bridge at Emrichsville, over the White river. It is to be a Melan arch, for which an appropriation of $165,000 has been made.

JERSEY CITY, N. J.—Bids are wanted June 19 by the Board of Chosen Freeholders, for putting in a new draw span and piers of the Newark avenue bridge over the Hackensack river, in Hudson County. John N. Noonan is Deputy Clerk.

JOHNSTOWN, PA.—Bids will soon be asked for building a $75,000 bridge over the Pennsylvania tracks at Station street, the cost to be jointly borne by the Pennsylvania Co. and the city.

MEDINA, OHIO.—Bids are wanted June 19 by the Board of County Commissioners for building the superstructure of the bridge over Rocky river in Liverpool township. It is to be 120 ft. long with 16-ft. roadway. W. H. Hobart, Auditor.

MOLINE, ILL.—Bids are wanted June 24 by the Board of County Commissioners, for building an iron bridge with concrete abutments. N. Erickson is County Clerk.

NEW YORK, N. Y.—Bids are wanted June 20 by Louis F. Haffen, President of the Borough of the Bronx, for building approaches to bridges over the New York Central & Hudson River and the New York & Putnam Railroads at Depot place and 177th street.

RAVENNA, OHIO.—The Pennsylvania will build a bridge between this place and Kent.

ROCHESTER, N. Y.—The New York Central has plans ready for rebuilding about six bridges in this city.

VANCOUVER, B. C.—A by-law has been passed to raise $350,000 for new bridges and improvements.

Other Structures.

CHANUTE, KAN.—The Atchison, Topeka & Santa Fe, it is said, will build large shops at this place, and also increase the capacity of its roundhouse, on which work is soon to be commenced.

CRANFORD, N. J.—The Central Railroad of New Jersey will ask bids in July for putting up twin passenger stations at this place, to consist of stone and brick structures one-story high, the eastbound station to be 21 x 71 ft. and the westbound 15 x 22 ft.

FORT WORTH, TEX.—The St. Louis & San Francisco is planning to build large machine shops at this place.

HOUSTON, TEX.—The International & Great Northern is putting up a brick and steel office building three stories high, 50 x 540 ft., to cost about $100,000, at this place, work on which is to commence at once.

JACKSON, MISS.—The Illinois Central will at once comply with the Railroad Commission's instructions and put up a passenger station, at a cost of about $250,000, here.

JENNINGS, LA.—The Southern Pacific, reports state, is planning to put up a station at this place to cost about $25,000.

MUSKOGEE, IND. T.—The Missouri, Kansas & Texas, it is reported, will spend about $1,000,000 for improvements at this place, to include a new freight yard, a roundhouse to hold 15 locomotives, a new freight warehouse and an extension to the present passenger station.

NORWOOD, MASS.—The New York, New Haven & Hartford, it is said, will build large car repair and machine shops at this place.

ROCHESTER, N. Y.—The Lehigh Valley is considering the question of putting up a new passenger station at this place, for which plans already made call for a structure to cost about $150,000.

SILSBEE, TEX.—A contract has been given by the Atchison, Topeka & Santa Fe to W. C. Whitney, of Beaumont, at about $25,000, for building a six-stall extension to the roundhouse; also for a machine shop at this place.

TERRE HAUTE, IND.—The Southern Indiana has given a contract to Joseph Haight, of Chicago, for building shops at this place and a number of stations along the line of its road.

TOLEDO, OHIO.—The Great Central is planning to build ore and coal docks at this place, to cost about $300,000.

WINNIPEG, MAN.—Negotiations are under way between the Canadian Northern and the Grand Trunk for jointly building a union station at this place. The Northern Pacific, it is said, is also interested in this project.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BALTIMORE & OHIO.—This company is making surveys in the neighborhood of Uniontown, Pa., for a line in connection with the Leckrone & Little Whiteley, from Leckrone into Green County.

BELINGTON & BEAVER CREEK.—This road will in future be operated as a part of the Western Central & Pittsburg Railway.

BIG STONY.—This road will in future be operated as a portion of the Norfolk & Western.

BIRMINGHAM & ATLANTIC.—The extension of this road from Pell City, Ala., west to Coal City, a distance of about nine miles, has been completed.

CHESAPEAKE & OHIO.—The extension of the Big Sandy branch on the Kentucky division has been completed from Prestonburg, Ky., southeast to Pikeville, about 30 miles.

CHICAGO, ANAMOSA & NORTHERN.—This company has opened its road from Anamosa, Iowa, west to Coggon, a distance of 10 miles.

CHICAGO, BURLINGTON & QUINCY.—A contract for building an extension of this road from Centralia, Ill., south to Herrin, a distance of 52 miles, it is said, has been given to J. H. Reynolds, of St. Louis, Mo.

CINCINNATI, MILFORD & LOVELAND (ELECTRIC).—Bonds are to be issued to raise funds for an extension from Loveland east to Blanchester, about 18 miles. B. H. Kroger, of Cincinnati, is President.

CLEVELAND & SHARON.—This company, which proposes to build a railroad from Middlefield, Ohio, to Sharon, has been reorganized and will issue bonds for $1,500,000 to pay the contractors, Joyce & Fawcett. Receiver T. C. Willard, of Cleveland, will be discharged, and the work will be pushed to completion. The length of the road will be 42 miles, connecting at Middefield with the Ohio Traction Co.'s line into Cleveland.

CLEVELAND, WOOSTER, MOUNT VERNON & COLUMBUS (ELECTRIC).—Arrangements have been made by this company and rights of way are being secured for building an electric railroad from Wooster, in Wayne County, Ohio, through Wayne, Holmes, Ashland, Richland, Knox, Licking and Franklin Counties, a distance of about 105 miles; also to build a line to Mansfield, a distance of 12 miles. Entrance will be made into Columbus over the tracks of the Columbus City Railway and traffic arrangements have also been made with the Cleveland & Southwestern.

COAL & COKE.—The extension of this road from Adrian, W. Va., south to Frenchton, a distance of six miles, has been completed.

COPPER RIVER & NORTHWESTERN.—Surveys are now in progress for this road, projected from Valdez, Alaska, northeast to the Copper river, a distance of about 40 miles, and thence to Eagle City on the Yukon river, about 270 miles additional. John Rosene, J.

D. Trenholme, of Seattle, Wash., and William T. Perkins, of Nome, are interested. The headquarters of the company are at Carson City, Nev.

Darien & Western.—This company has opened the extension of its road from Houston, Ga., for a distance of four miles.

Erie & Jersey (Erie).—Incorporation has been granted this company in New York with a capital of $600,000, to build a low-grade line from Highland Mills, N. Y., on the Newburgh branch of the Erie, to a connection with Campbell Hall, and thence through Otisville and joining the main line of the Erie at Guymard, in Orange County, a distance of about 42 miles. The new line will cut off the steep grade between Middletown and Otisville. Three surveys have been made, one of which will be selected shortly.

Escambia.—This road has been opened from Century, Fla., a point on the Louisville & Nashville, north and west via Jordan and McNeill to Camp 11, Ala., a distance of 46 miles.

Farmers' Grain & Shipping Company.—An officer writes that the contract for building the extension from Starkweather northwest to Rock Lake, N. Dak., 30 miles, has been let to A. Guthrie & Co., of St. Paul, Minn. Ten miles have been graded and it is expected to have the entire line in operation in July. The work is not heavy and there are no important bridges or tunnels to be built. The entire line will be about 55 miles long extending from Devil's Lake, N. Dak., to Rock Lake, and crosses the Minneapolis, St. Paul & Sault Ste. Marie at Lakeview.

Grand Trunk.—The double tracking of the line from Hamilton to Lynden, 14 miles; from Brantford to Paris, 7.8 miles, and from Paris to London, about 47 miles, has been completed on the line to Sarnia and the double track is now in operation. The work of double tracking the division from Kings Court Junction to Komoka, 27½ miles, will be carried out during the present year, leaving only about 30 miles of single track between Montreal and Chicago via Hamilton, a distance of 845 miles.

Kansas City Outer Belt.—This company, which early this spring let contracts for building its line to afford terminal facilities for the Kansas City, Mexico & Orient and other companies, is selling $500,000 of bonds, the proceeds of which are to be used to complete the double tracking of its road and build a bridge over the Missouri river.

Liberty-White.—An officer writes that this company has obtained permission from the Mississippi Railroad Commission to change its eastern terminus to Columbia, in Marion County or to some point west of Columbia. About 15 miles of the extension now building east, it is expected, will be completed shortly. (April 28, p. 143.)

Mason City & Fort Dodge.—This company has filed an amendment to its articles of incorporation in Iowa increasing its capital stock by $14,000,000, making the authorized capital stock $34,000,000. It is understood that the purpose of the increase is to take over the properties of the Mason City & Clear Lake Traction Co., operating 18 miles of electric road in Cerre Gordo County, and the Waterloo, Cedar Falls & Northern Railway, operating 89 miles of steam and electric lines in Black Hawk and Bremer Counties, and to build a road 50 miles long to connect these properties; also to build a line from Arispe, in Union County, Iowa, on the Kansas City line of the Chicago Great Western, to Carroll, Iowa, on the Omaha-Fort Dodge division of the Mason City & Fort Dodge line, about 90 miles. A. B. Stickney and L. S. Cass, of Waterloo, are said to be interested in this company.

Monongahela.—The Dunlaps Creek branch of the Connellsville Central, from a connection with the Monongahela Railroad at Dunlaps Creek Junction to Shamrock Branch Junction, a distance of 10 miles, and the Salt Lick Run branch from Low Phos Junction to the Connellsville Central Coke Works, a distance of 2½ miles, have been placed in operation.

New Orleans & Great Northern.—This road, which is being built by the Goodyear Syndicate, of Buffalo, N. Y., from Slidell, La., north through the valley of the Pearl river to Monticello, Miss., a distance of about 100 miles, is rushing the work. Connection will be made with the New Orleans & Northeastern at Slidell, and may also be made with the Mississippi Central and the Illinois Central at Monticello. C. W. Goodyear is Vice-President, and N. G. Pearsall, Covington, La., is General Manager.

New York, Westchester & Boston (Electric).—This company, which proposes to build a road from the Harlem river in the borough of the Bronx, where connection is to be made with the subway and elevated lines, north to Mt. Vernon, with a branch along the sound through or near Pelham, New Rochelle, Larchmont, Mamaroneck, Harrison and Rye to Port Chester, also a branch reaching Bronxville, Tuckahoe and Scarsdale, terminating at White Plains, has commenced construction work on the first section, under the supervision of E. V. Maitland, Resident Engineer in the Bronx.

Ohio & Marshall.—Two surveys have been completed by this company, which was recently incorporated in West Virginia, and rights of way have been secured for building its proposed road to connect the Connellsville coke region with Wheeling and Benwood. (April 28, p. 143.)

Ohio, Knoxville & Port Royal.—Under this name, a consolidation of the Ohio River, Anderson & Tidewater, the Western Carolina and the Ohio, Knoxville & Port Royal has been made in South Carolina to build a railroad under the privileges held by these three companies from some point in the west to a terminus at Port Royal, S. C. Albert R. Martin, of Chicago, is President; F. A. Johnson, First Vice-President and General Manager, and J. E. Breazeale, Secretary.

Opelousas, Gulf & Northwestern.—Surveys are being made for a line from Melville, La., southwest to Opelousas, a distance of 25 miles. On the completion of this portion of the road, the company expects to build from the latter place southwest to Crowley, about 30 miles. L. E. Littell, of Opelousas, La., is Chief Engineer.

Orange & Northwestern.—A contract has been given to Hammond & Kenefick, of Kansas City, Mo., to build from Buena, Tex., north to Newton, a distance of about 31 miles. Announcement has also been made that the road will be continued northward to ultimately reach Arkansas.

Oregon Railroad & Navigation.—Surveys are being made and rights of way secured for a new route for the proposed extension of this road from Riparia, Wash., east along the north bank of the Snake river to Lewiston, Idaho, a distance of about 78 miles.

Pacific & Idaho Northern.—Announcement has been made that work will be commenced on an extension of this road towards Thunder Mountain, Idaho, and about 100 miles of road is to be completed this year. E. M. Heigho, Weiser, Idaho, is General Manager.

Pennsylvania.—This company, it is said, will have its double tracking from Cincinnati to Columbus completed within one year.

Philippine Roads.—The War Department at Washington, D. C., is asking bids from individual citizens or copartnerships of the United States or of the Philippines, or from railroad corporations organized and existing under the laws of the United States or the Philippines, for building railroads in the Philippines as follows: From Dagupan to Laoag, 168 miles; from San Fabian, via Twin Peaks, to Baguio, with the option of continuing to Trinidad, 55 miles; from Dagupan to Cabanatuan through the Carabella Pass and down the valley of the Cagayan river to Aparri, 260 miles; from Manila north to connect with these lines to Laoag Benguet, and Aparri, 120 miles. From Manila to Batangas, 70 miles, with a line from Calamba to Santa Cruz, 25 miles, and another from Lapa or other convenient junction in Batangas to Lucena, 35 miles, making a total of 130 miles from Pasacao to Ligao, with a line from Ligao to Tabaco and across the island of Cacraray to the harbor of Batan, and with the main line extending to Legaspi, on the Gulf of Albay, all approximately 100 miles; from Iloilo, in a northerly direction, to Capiz and Bataan, on the north coast of the island of Panay, approximately 100 miles. On the island of Cebu, from Cebu to Danao, and south from Cebu to Argao, with the option of a line to Carcar to Sibonga to the west coast, and thence along the coast between Dumanjug and Barili, 95 miles in all. On the island of Leyte, one line to Tacloban and Carigara; the other from Tacloban to Abuyog, 55 miles. On the island of Samar, from Paranas, on the west coast, to San Julian, 50 miles. Provision is made for the acquisition of the railroad from Manila to Dagupan, now in operation, if satisfactory arrangements with that road can be made.

Pike County.—Incorporation has been granted this company in Arkansas, with a capital of $56,000, to build a railroad from Gurdon, in Clark County, northwest to Hollywood, about 14 miles. The incorporators include: C. C. Jackson, C. G. Carpenter and M. J. Hall, of Clark County, and William Grayson and N. W. McLeod, of St. Louis.

Pine Bluff & Western.—This road is now in operation from Benton, Ark., to Pine Bluff, a distance of 46 miles.

Somerset Railroad.—This company, which proposes to build an extension from Austin deadwater, Me., to the head of Moxie pond, within 10 miles of the Canadian Pacific, will eventually be extended to Birch Point, on the shore of Moosehead lake, opposite Kineo. A contract has been given to A. R. McHenry & Co., of Philadelphia, for about 18 miles. Contracts are expected to be let during the present year for 30 miles additional.

South Bend Western (Electric).—Incorporation has been asked for by a company under this name in Indiana with a capital of $100,000, to build an electric road to Laporte and to acquire the Chicago & South Shore line, now operating between that place and Michigan City. W. L. Taylor is President; M. P. Reed, Vice-President; W. W. Babcock, Secretary, and C. G. Lohman, Treasurer.

Southern Indiana.—Subways are about completed for building an extension of this road from Bedford, Ind., southeast via New Albany to Louisville, a distance of about 78 miles. This extension will parallel the Chicago, Indianapolis & Louisville, but will be 10 miles shorter than that road.

Southern Pacific.—Announcement has been made that surveys are practically completed for building an extension from Alexandria, La., southeast to Baton Rouge, about 120 miles, and the contract for the work will be let shortly.

Spokane International.—This company, which was incorporated in Washington to build a railroad from Spokane to the international boundary, has given contracts to Twohy Bros. and Winters, Parsons & Boomer for part of the distance, and other contracts are expected to be let during the present year for the remainder. It is planned to have the road in operation by June of next year. D. C. Corbin, Spokane, is President.

Standard & Baton Rouge.—Incorporation has been asked for in Louisiana by a company under this name with headquarters at Monroe to build a railroad from that place through Ouachita and Caldwell parishes to Standard, in Catahoula parish, and south to Cheneyville, in Rapides County, a distance of about 115 miles. The officers and directors include: J. B. York, President; J. F. Rutherford, Vice-President; C. J. Santag, Secretary and General Manager, and others.

Susquehanna & New York.—This company, it is reported, will extend its line from Ralston, Pa., to English Center via Roaring Branch and Blackhorse. The survey follows

Lycoming creek from Ralston, the present terminus, north to Roaring Branch, and then west, touching at Liberty, and thence down Blackhorse creek to English Center, a distance of about 26 miles.

TENNESSEE CENTRAL.—A contract has been given to W. J. Oliver & Co., of Knoxville, Tenn., to build a spur from Obey City, Tenn., to the coal mines of the Fentriss Coal & Coke Co., a distance of five miles.

RAILROAD CORPORATION NEWS.

ALABAMA GREAT SOUTHERN.—An interim dividend of $1.92 per share (less tax) has been declared on the "A" preference shares of this company.

BERKSHIRE.—The Massachusetts Railroad Commissioners have authorized the Berkshire, the Stockbridge & Pittsfield and the West Stockbridge railroads to consolidate into one corporation under the name of the Berkshire Railroad Co., with a capital of $1,078,700. All of these roads are leased by the New York, New Haven & Hartford.

CHATHAM, WALLACEBURG & LAKE ERIE (ELECTRIC).—A meeting of the stockholders of this company, which is building an electric line from Chatham, Ont., to Wallaceburg, will be held on June 20, to authorize the issuing of bonds, debentures or other securities.

CHICAGO GREAT WESTERN.—The shareholders will vote at a meeting to be held on September 7, on a proposition to increase the preferred "B" stock by $14,000,000. This amount would add 70 per cent. to the present amount of preferred stock and nearly 20 per cent. to all stock issued. The company has already authorized four kinds of stock: 4 per cent. debenture stock, 5 per cent. preferred "A" stock, 4 per cent. "B" stock and common stock. Of the first class, $30,000,000 has been authorized and about $26,000,000 has been issued; of the second class, $15,000,000 has been authorized and about $11,000,000 issued; of the third class, $10,000,000 has been authorized and $9,000,000 issued; and of the common stock, $50,000,000 has been authorized and $30,000,000 issued. Thus stock to the amount of $105,000,000 has been authorized, of which about $76,000,000 has been issued. Since January, 1900, 5 per cent. has been paid upon the preferred "A" stock in addition to the regular 4 per cent. on the debenture stock. No dividends have been paid upon the two junior classes of stock.

CHICAGO, ROCK ISLAND & PACIFIC.—The Consolidated Indiana Coal Company was recently incorporated, with $4,000,000 authorized capital stock to take over a number of coal properties bought by the Rock Island System on the lines of the Evansville & Terre Haute, Indiana Southern and Chicago & Eastern Illinois. Controlling interest in the capital stock of this company is owned by the Rock Island. The coal company has made a mortgage to secure an issue of $4,000,000 first-mortgage 30-year sinking fund 5 per cent. gold bonds of 1935, of which $1,500,000 are reserved and $2,500,000 have been sold to Speyer & Co. The interest on this $2,500,000 is guaranteed by the Chicago, Rock Island & Pacific Railway. The bonds are protected by a cumulative sinking fund of 5 cents per ton of coal mined. With this bonds are to be bought at the market up to 110; but, if not obtainable at that price, are to be drawn for redemption at 110.

DETROIT, TOLEDO & IRONTON.—Representatives of this company have bought control of the Ann Arbor and the two roads will probably shortly be consolidated. The purchasers have acquired 30,010 shares out of the total of 40,000 shares of preferred stock of the Ann Arbor and 21,900 shares out of the total of 32,500 shares of common stock. Payment was made with $5,500,000 3½-year 5 per cent. collateral trust notes secured by the acquired shares of the Ann Arbor and by $5,000,000 general-mortgage 4½ per cent. bonds of the Detroit, Toledo & Ironton. These notes have been underwritten by Rudolph Kleybolte & Co., who sold the Ann Arbor stock. It is reported that when the roads are combined, Joseph Ramsey, Jr., will retire as President of the Ann Arbor and will be succeeded by George M. Cumming, President of the Detroit, Toledo & Ironton. This consolidation will give the Detroit, Toledo & Ironton 714 miles of line from Ironton, on the Ohio river, to Frankfort, near the north end of Lake Michigan.

HUDSON VALLEY.—An order has been issued in the Supreme Court of New York State arresting the execution of the judgment appointing J. P. O'Brien, of Troy, Receiver of this company. This action stands until Justice Kellogg, who issued the original order, shall return from Europe and review the judgment.

INTERBOROUGH RAPID TRANSIT.—A dividend of 2 per cent. has been declared on this company's stock. Although it is not officially stated to be a quarterly dividend, it is probable that the stock will now be placed on an 8 per cent. basis. The first dividend paid was of 2 per cent. on July 1, 1904. On January 2, 1905, 3 per cent. was declared, and on April 4, 1¾ per cent., making a total for the year of 8¾ per cent.

KANSAS CITY-WESTERN (ELECTRIC).—This company was formerly the Kansas City-Leavenworth Railroad. It has been bought by Fisk & Robinson, of New York, who will issue $1,500,000 20-year 5 per cent. bonds (part of an authorized issue of $5,000,000) and $2,500,000 capital stock. The lines owned, including the mileage in Leavenworth and Kansas City, are 34.3 miles long. The road will terminate at the viaduct which is to be built within two years by the Kansas City Viaduct & Terminal Railroad, between Kansas City, Mo., and Kansas City, Kan. Conway F. Holmes is President and General Manager of the new company.

MASON CITY & FORT DODGE.—This company has filed a certificate increasing its capital stock from $20,000,000 to $34,000,000.

MICHIGAN CENTRAL.—The Canada & Michigan Bridge & Tunnel Co., and the Michigan & Canada Bridge & Tunnel Co., which were incorporated to build a tunnel under the Detroit river, are to be taken over by a new company, to be known as the Detroit River Tunnel Co., to be organized under the laws of Michigan. This company is to be capitalized at $4,000,000 and is to build the Michigan Central's tunnel under the Detroit river at Detroit. The estimated cost is $8,000,000. It is reported that work will be begun about October 1.

NORTHERN CENTRAL.—A semi-annual dividend of 4 per cent. has been declared payable July 15. This completes the first full year's distribution on the $5,731,125 stock issued in 1904. The total amount of stock at present outstanding is $17,193,424.

PERE MARQUETTE.—A semi-annual dividend of 2½ per cent. on the common and 2 per cent. on the preferred stock of this company has been declared. This is in accordance with the terms of the lease to the Cincinnati, Hamilton & Dayton, which guarantees 5 per cent. annually on the common and 4 per cent. on the preferred. The common stock paid 2 per cent. in 1903 and 1 per cent. in 1904.

PITTSBURG, FORT WAYNE & CHICAGO.—This company has listed $3,341,900 additional 7 per cent. special guaranteed stock on the New York Stock Exchange. This is part of an account issued to the Pennsylvania to pay for advances. Special guaranteed stock is issued, as the Pennsylvania asks the return of advances made. In 1904 $4,959,200 was issued; in 1903, $2,010,400; in 1902, $1,418,200, and in 1900, $1,291,200.

PITTSBURG TERMINAL RAILROAD & COAL.—This company has filed a consolidated mortgage of $14,000,000 with the Bowling Green Trust Co., of New York, to secure that amount of 50-year 4½ per cent. gold bonds. Part of these bonds will be used to redeem the recent $6,000,000 mortgage of the company, part to redeem outstanding bonds of the West Side Belt and part to provide funds for short extensions necessary to reach important points in the Pittsburg district.

ST. LOUIS, IRON MOUNTAIN & SOUTHERN.—This company has listed $2,443,000 additional River & Gulf division 4 per cent. bonds. These were sold to pay for further construction on the White River line. They were issued at $30,000 a mile of main track, $15,000 a mile of second track or branch lines and for terminals and equipment at cost. The previous aggregate of these bonds outstanding was $18,734,000.

TOLEDO, ST. LOUIS & WESTERN.—According to the agreement of August 1, 1900, between the reorganization committee of the Toledo, St. Louis & Kansas City and the voting trustees, the preferred and common stock certificates of the Toledo, St. Louis & Western held under the voting trust, will be distributed on July 1.

WABASH.—The Mercantile Trust Co., of New York, on June 12 filed suit in the Federal Court at St. Louis, asking for an accounting of the operation of the Wabash Railroad since July, 1899. The attorney for the trust company says that the action should not be regarded as unfriendly, as it is an attempt to get the court to construe the mortgage and decide what earnings shall be applied to interest payments. According to his statement, the annual reports show at least $432,360 available for interest on the debenture "A" bonds and $892,341 on the debenture "B" bonds. The petition also declares that, as the bonds prior to the debentures require only $2,378,630 in interest, while the 1904 report shows that $3,092,423 was in that year paid in interest, the company has paid interest on bonds junior to the debentures. On the same day that the petition was filed, the directors of the road decided not to make any distribution at this time on the "A" bonds. The full 6 per cent. interest on the "A" bonds was paid from 1890 to 1893 inclusive. In 1894 and 1895 the interest was passed, in 1896 1 per cent. was paid, in 1897, 1898 and 1899 no distribution was made, and from 1900 to 1904, the full 6 per cent. was paid. In July, 1904, and January, 1905, the interest was passed. No interest has ever been paid on the "B" bonds.

WASHINGTON, BALTIMORE & ANNAPOLIS (ELECTRIC.)—This company has organized the Baltimore Terminal Co. to secure new terminal connections in the city of Baltimore and has petitioned the members of the Baltimore City Council to pass an ordinance, which is published by advertisement in the local newspapers, granting the right to the Baltimore Terminal Co. to build one of three designated alternative routes. The Washington, Baltimore & Annapolis is a consolidation of electric lines bought a few months ago by the Bishop-Sherwin syndicate, of Cleveland. The proposed lines, when completed, will run from Baltimore to Washington, and from Annapolis, via Annapolis Junction, Laurel and Berwyn to Washington. According to the advertisement, the necessary terminal connections have already been secured in Washington and Annapolis.

A mortgage to secure $3,000,000 first-mortgage 30-year gold bonds has been filed by this company; the Cleveland Trust Co., of Cleveland, Ohio, is trustee.

YOUNGSTOWN & SOUTHERN.—Baker, Ayling & Co., of Boston, are offering at 97 and interest a block of the first-mortgage 5 per cent. sinking fund gold bonds of 1923, of this company, which has recently been bought by a Youngstown (Ohio) syndicate. The company has $1,800,000 stock authorized and issued, and $1,500,000 first-mortgage 5 per cent. bonds authorized. Sixteen miles of line from Youngstown to Columbiana are now in operation and an extension of 35 miles to East Liverpool and 10 miles of new second track and spurs to coal mines, are planned.